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N.S.
1
Lectures
on the

Institutes of Physic
By

Wm. Cullen M.D.

Professor of Medicine in the
University of Edinburgh.
Vol. I

1767-8. -

"Physic, & Physic: Law lay hid in night

"God said - let Cullen be, & all was light.

Larcon

Written by
Benjamin Rush.

4

1767.

9.

Nov: 16th Dr Cullen's Institutions of Physic.

The Institutions of Physic do not consist in mere theoretical Speculations. They are designed to illustrate & set forth the Rules of practising Physic. in order to do this a Physician sh^d. be well acquainted wth the State of the Body in Health, and all its Deviations from it in Diseases. he sh^d. also know how the various powers of Nature affect the Body so as to induce Disease w^{ch} is the study of Remote Causes. the business of the Institutions of Physic is to deliver y^e general doctrines or principles of medicine. we shall then 1st treat of the Doctrines of Health w^{ch} is called Physiology 2nd of the Doctrines of Disease w^{ch} is called Pathology 3rd of the Operation of Medicines in curing these Diseases w^{ch} is called Therapeuticks, or the Methodus Medendi.

In the Physiology I shall often take Occasion to point out the Pathology

Introduction.

or Diseases to which the part we have treated off is subject. by this means we shall better understand the Nature & Functions of $\frac{1}{4}$ different parts of the human Body in Health.

we shall divide our Physiology into 2 parts. 1st As it treats of the Functions peculiar to both sexes or the whole human species, & 2nd as it treats of those Functions which are peculiar to each of the sexes.

Lect. 2nd

we shall begin by first explaining the Nervous System, as the Brain & Nerves are primary Agents in all $\frac{1}{4}$ Functions of the Body, even the Action of the Heart & Circulation of the Blood depend upon an Influence of the nervous powers. After this we shall proceed to the Distribution of the Fluids or to the Circulation of $\frac{1}{2}$ Blood.

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Introduction.

I shall call this the Hydraulic part of our System as the Blood in its Circulation is subject to γ common Laws of Hydraulicks. we shall then explain in ω Manner γ Fluids are constantly renewed. This will constitute the 3.^d part of the Physiology which we shall call the Chemical part of our System. This you may readily see includes those Functions ω are called vital & natural. After this we shall subjoin an Account of the Functions γ are peculiar to each of the Sexes.

Before I enter upon the Dispersion of γ . Nervous System I shall say a few things concerning the Nature of a simple Fibre on simple Solids. I shall divide this part into Heads (or) of their different Forms

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4

of the simple Solids.

(b.) of the more general Functions of ^c simple Solids (c) I shall consider the different

(c) States of Solids of wth affect them.

(d) of the Pathology of the simple Solids

(a) of the different Forms of the Solids

you all know from Anatomy ^{it} is a Cellular Lecture. you will find in ^{Dr} Haller very fully discussed. we never find even two Fibres applied together wth out the Interposition of cellular Substance. Some Anatomists suppose the whole Body to be cellular more loosely or closely compacted together. the membranes are nothing but a close compact cellular Substance. the Bones themselves were originally Membranous therefore we may presume they are likewise cellular. does this apply to ^c Nails - Horns - Hoofs &c of Animals?

(12.) we infer this from the simple & distinct
Sensations ^{ch} w: are communicated by every
single nerve to the Brain.

5

of the Simple Solids.

— This I think very doubtful. but it does not relate to our present purpose, even supposing parts of the body to be fibrous it does not affect ^{their} ~~the~~ texture in the least. when we come to examine them we shall find them both the same. see Dr Haller de Fibra et Tela Cellulosa in the beginning of his Præleminæ. we allow the existence of Fibres in the muscles and Tendons, but they are always distinct from the Cellular Substance. — even the medullary part of the brain appears to be arranged in a fibrous manner, and when we consider the nerves are conti? from the medulla we may presume the nerves also have a fibrous arrangement. Especially when we add to this, that the nerves & medulla are the Embrio parts of the body & these we are sure are fibrous. ^{or} the Application of this will appear more fully

of the Simple Solids.

Hereafter when we are showing how far every part of the Body is derived from the Nerves.

I cannot help thinking y: the Fibrous Structure is the most Original, and y: the Cellular Substance arises from it.

Lect: III.

I mention this because a late ingenious French writer One M^r Bourdieu, who has wrote on the cellular Texture of Animals in w^h he tells us he has demonstrated Fibres in w^h has been supposed to be cellular.

He Observes that these Fibres are found in all Animals. hence the powers w^h produce them are always uniform & the same. all Changes in the Solids then are in y^e Cellular Texture, & not in the simple Fibres. This Hypothesis is ingenious, but cannot be supported. his Notions of Fibres are taken only from Muscles, & ~~are~~ his Observations

Mr. Meigs

Let: m

of the Simple Solids.

were made wth Microscopes wth we know are
 very fallacious. a later Author^{as} has train-
 ed the same Opinion, but I think wth is mis-
 taken than M^r Desboudaux. we must
 consider muscles not as simple Fibres
 but as Organized Bodies as we shall
 show hereafter.

(6) The Functions of the Solids. solidity
 was necessary to give Firmness to the
 Body wth is always exposed to Injuries
 & Accidents, as also to serve as Agents
 in promoting the Circulation of Fluids.
 - it was necessary the solids sh^d have a
 certain Degree of Cohesion - Flexibility &
 Elasticity which we observe in them.
 all the solids in our Body are composed
 of one of these three properties or of all
 of them as was necessary for their

(a) or that they were Heterogeneous
Aggregates. in the same manner as
Lime Mortar which is sand cemented
together by Lime. —

of the Simple Solids.

Functions.

1st The different states w^{ch} affect the Cohesion Flexibility & Elasticity of the Solids.

Thin Cohesion depends upon their nature as most bodies. It is upon the Difference of matter w^{ch} constitute the Solids, united more or less compactly according to the matter ^{of} which they are composed.

Dr Boerhaave supposed $\frac{1}{2}$ all the Solids are composed of Earth & Gluten. 1st

But this they infer from Calcinations & from a Gluten w^{ch} is extracted from Bones by Pappier Digestion.

to the 1st viz Calcination we Object all that can be said Ag^t Chemical Analysis in general. Thus if a Bread Pudding be analysed, it will by no means yield those principles of which

(a) The Fire in Chemical Operations
induces a new Aggregation in Bodies
& does not teach us w: principles
Microtis in the Maps.

(b) even this Earth is a Compound
of Air & Salt. This kind of Doctrine
arises from the Old Corpuscularian System.

(c) Air w: ⁱⁿ the most essential Fluid Body
in nature when united w: certain
Bodies form $\frac{1}{4}$ most solid Concretes.

of the Simple Solids

it is compound, such as Flower-water Eggs &c.
a new Arrangement is given to the
matter, & new Compounds are formed. ⁽¹⁶⁾

— the Earth in the Solids is the basis
of the Gluten, & can be extracted from
it. it is unphilosophical to seek for
the Cause of solidity, as it does not
arise from any one Elementary Body
but from a Conjunction of a
considerable Number of them. Thus
Vegetables are resolved into $\frac{1}{4}$ same
Earth, ⁽¹⁶⁾ but can ^{it} be the Cause of their
Solidity? — no. The Solidity then of
all Bodies depends upon a certain
Arrangement th which is altered by Fire.
the same Principles when differently
arranged would perhaps form a soft Body.

1791

My dear Sir
I have the honor to acknowledge the receipt of your letter of the 10th inst. in relation to the
business of the Bank of the City of New York. I am sorry to hear that the
affairs of the Bank are in such a state of confusion. I am sure that the
Board of Directors will be able to bring them to order. I am, Sir,
Very respectfully,
Your obedient servant,
J. B. C.

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of the simple Solids.

as to the 2nd Argument, it proves nothing
the Gluten arises from a Decomposition
& did not preexist in the Body.

~~I do not believe of the solid nature~~
~~of~~ Having rejected the Hypothesis of
Dr Boerhaave I now add y^t: Altho' we find
Heterogeneous Masses in Nature, yet we
have proofs y^t the Animal Solids are
composed of Homogeneous Aggregates.
— They were originally in a fluid Form, and
by the dissipation of moisture become solid.
— Thus a Spiders web by being drawn out
becomes solid altho' it lay in y^e Spiderine fluid
form. Besides the Animal Solids are perfectly
transparent w^{ch} shows their Simplicity.
— I will not deny but they are
Compounds for I believe Nature has

11

Of the Simple Solids.

presented us wth ^{2d} nothing in a simple form -
- The Chemists indeed tell us of Air -
Sulphur &c entering into ^{the} Composition
of all Bodies, but this Notion is now exploded.

This Compound may differ in the
proper proportion of its parts or from
the Insinuations of foreign matter,
on this the different states of Cohesion
Flexibility & Elasticity in ^{the} Animal
Solids may depend. But when these
variations of proportion take place
or when foreign matter is insinuated
is difficult to tell. we can hint at one
or two Cases only, in the ~~Case~~ ^{Case} when some
Degree of Putrefaction takes place a late
ingenious Author has shown us that
it is occasioned by a Defect or Abstraction
of Air which is one of the principles con-

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of his school is not a small number
it is necessary by self instruction
to improve but the time is short
and of late years the number of
those of foreign birth who are
in the different parts of the Colonies
the consequence is a great number
of the population of the Colonies
are of foreign birth. But when the
Government of the Colonies is
in the hands of foreign merchants
it is difficult to see how the
Colonies can be improved. The
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of the simple Solids.

= 1st part of the animal Solids.

2nd: in many Diseases as in Cancer &c. when some foreign Matter is introduced which changes the state of Cohesion.

3rd: Water when introduced may alter the Aggregation of our Solids, so that a greater or lesser proportion of this fluid may change the state of Cohesion in the Animal Solids.

— ~~but~~ all nutritious Matter is applied in a watery form, now if this is sent in too great a proportion or if it has not been properly abstracted, or if after being abstracted it is again effused ^{it} follows of consequence we shall have a Change in the nature of the Solids.

If again this Fluid is sent in too small a proportion, or if too much is abstracted or dissipated then a Difference of

12

of the simple solids.

Aggregation will likewise follow. the direct Converse of the former viz. ^e Solids will become more coherent - less flexible, & more liable to Diseases. - I speak here only of the soft Solids. I shall have occasion to say hereafter that the Bones are composed of Petrogenious parts.

Dr Bryan Robinson by his Experiments on Animal Fibres found ^e all Liquids tend to elongate them. But he never found anything that contracted a Fibre thus relaxed or elongated. see his Tables in his Treatise on the Anim. Economy.

From ^{what} he has said I w^d infer that no Liquid relaxes ^{more} ~~but~~ than hot water except spirit vitriol w^{ch} acts rather as a solvent than Relaxer.

a solution of common salt relaxes

161 hence he tells us y^t Oils relax
very little. now we are sure y^t Oils re-
- lax most of any fluids when applied
to the skin.

162 For he never distinguished between
different kinds of spirits he used. nor
does he seem to understand y^e nature
or difference between the two various
kinds of Alkaline salts.

of the animal solids.

13

The least of any Liquids the reason ^{of} ~~is~~ ^{is} owing to the salt, prevents the free passage of the water into the animal solids, and this is the case ^{the} w: all the Impregnations of water. I would ^{not} have you however trust too much to these Experiments For; he used Human Hairs as his animal solids; ^{now} ~~for~~ they are so close & compact in their Organization as not to admit the Infiltration of fluid Bodies so readily as other parts of animal matter. ^{(4) no} 2. he is very inaccurate in his Chemistry & loose in his Chemical Reasonings. ⁽⁶⁾ He tells us y: Vinegar ~~is~~ ^{is} less than water, but every Anatomist will tell you y: Vinegar softens the Bones more than any Fluid in Nature.

I wish some of you Gentlemen w:^d repeat these Experiments ^{the} w: more accuracy.

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14

of the Animal Solids.

Dr Kales in his Hamistatichs gives us several Experiments y^t lead to some general good Conclusions on this Subject, & tho' his manner of conducting them dont seem to be altogether proper.

We return now to consider the Animal Solids^{ch} w^e we sup^d composed of water & other matters. its strength or solidity depends upon the proportion of this matter to the water. we shall enquire in to the remote Causes w^{ch} give these different proportions of fluid & solid matter. They will depend iⁿ upon the Quantity & Quality of nourishment taken in, and y^e Condition of its Application. If too much nourishment introduced tends to increase the proportion of water especially if no Exercise is used to dissipate y^e superfluous

as the more nutritious Aliment is the
Larger & stronger Tribe it gives, & vice
versa. Water when combined wth Nutri-
ment tends to make it go further, so
those who near Calves suddenly can
witness, from whence we see ^{the} necessity
of Nourishment being applied in a fluid
Form.

of the animal solids

moisture. if Exercise is used it will tend to
enlarge the solids & in ~~old~~^{grown} subjects to harden
them. Too little nourishment gives a small
& rigid fibre. ^{the} Regard to the Quality they
act according to the proportion of nutritious
matter they contain. (a) Cohesion & Flexibility
is different in different constitutions - Ages,
Sexes, - & Temperaments.

The Elasticity of the solids depends not
only upon ^e proportions of the constituent parts,
but upon their Arrangement likewise.]

The Growth of the body will depend
upon ^{the} ^{re} state of the Evacuations. too great
Exhalation or Perspiration prevents
nourishment (tho taken in ever such
Quantity) from being applied to the
Nutrition of the body. 2nd it will depend
upon the state of ^e assimilating powers.

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of the Animal Solids

Therefore neither Quality nor Quantity can give nourishment Unless they are suited to these powers. 3.^d it will depend upon the powers which apply it such as Exercise - the Temperature of $\frac{1}{2}$ Air & Other Circumstances not understood such as perhaps Pressure. &c Exercise tends to harden the Solids, hence hard Labour in early Life tends to limit the Growth of the Body. Heat by increasing the Motion of the Nutritious Fluid, and thus encreases the Quantity applied - hence people arrive sooner at their Acme in warm Climates $\frac{2}{3}$ in cold. Dryness increases the Effects of Heat & Cold - Moisture diminishes $\frac{2}{3}$ both ^{these} influences $\frac{1}{2}$ Growth of $\frac{1}{2}$ Body considerably. 4.th it will depend upon

the Original Stamina of different Con-
-stitutions which cannot be investigated
by us. —

we shall now point out ² several
Causes of Tension in the Body.

1st The Tension of Ligaments will depend upon
the Bones they are attached to. they
will therefore be greatly influenced by the
Growth of the Bones.

2nd The Ligaments of the Body are stretched
by weights constantly appended to them.
— such as one Bone prevailing over
another — Our Dress. Occupations in
Life &c.

3rd Some parts of the Ligaments of the Body
are at times overstretched by the
Matter they contain — such as the
Intestines & Stomach — w^h are over-
-distended

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Of the simple solids.

^{the}
 w: Aliment or wind. when the Tension
 of these is destroyed we find the whole
 Body bro't into Lymphy. we find
 the Lungs greatly influence every
 Fibrous part of the body. hence when
 we want to erect the whole body we
 fill the Lungs by a large Inspiration.
 - the Thorax & Abdomen kept in
 a state of Tension by the vapour ^{or} ~~perme-~~
 red out into them w: is in an Elastic
 state. this too I believe tends to keep
 the Cellular Membrane in its proper
 State of Tension. we have some
 Reason to think the Cellular Mem-
 brane is a permanent Serial Membrane
 constantly filled w: ^{the} Air. consent
 M: Jones on this subject. if ~~do~~

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19

Of the simple solids

This is the Air may not this Air
tend to keep the Fibres in a state of
Tension? But further if the
Fibres are hollow, may they not be
filled wth a subtle Fluid w^{ch} contributes
likewise to keep the Fibres tense. These
Causes hitherto pointed out are in-
-ternal, But there are several exte-
-nal Causes w^{ch} influence the state of Tension
in the Body as the different states
of the incumbent Air. The Tension
is further kept up iⁿ by all the parts
of the Body being United together more
than one Fibre, or Membrane. Now if
any of these are destroyed, the Tension will
of consequence be diminished, as we see
in Aneurisms from the internal Coat of

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an Artery being wore away. 2nd The state of
Tension will be varied by the Exercise or
Action w^{ch} the Fibres undergo. 3rd the
Fibres will be firm & Elastic in proportion
as they are filled wth vapour. But if they
are filled wth Inelastic Matter instead of
Vapour a Flaccidity will be induced.
4th a morbid Rigidity will be induced
when the Matter w^{ch} forms the Bones
is effused into the cellular Membrane.
5th a Rigidity will be induced when y^e
coagulable Lymph stagnates in the
cellular Membrane.
6th a morbid Flaccidity will be bro't on
when a solid Matter is washed from
a part to w^{ch} it belongs as in y^e Cases
where the Bones grow soft. This may

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21

of the simple solids

occasioned by too much water being insinuated into them? But why ~~are~~ ^{do} we find them swelled if this is the case? we generally find them diminished. The water then must act as a solvent & thus wash out the solid parts of the Bones. But how this water acts as a solvent I cannot say. we are sure it is not Acid, nor can I think it has any kind of ~~acid~~ ^{alkaline} property.

7. The state of Tension in $\frac{1}{2}$ Cellulose Membranes will be varied according as it is kept ^{contracted} longer or shorter in a ~~contracted~~ ^{stretched} or stretched state.

(d) we come now to treat of the Pathology of the simple solids. But of this we have hinted pretty largely

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When speaking of their Physiology.

I shall 1st point out their Morbid Affections
 & 2nd endeavour to point out their
 Causes.

1st These Morbid Affections are to be
 considered in two views (a) the naturally
soft parts (b) the naturally hard parts.
 - (a) the soft parts are liable to disor-
 - ders from the Excess & or Defect of
 Cohesion Elasticity & Flexibility. we
 must observe y these are even in a healthy
 state different in different Ages. w: is
 Rigidity in a young person is Healthy in
 an old person. the first Diseases they
 are subject to, are Debility Flaccidity &
 Laxity. By Debility I understand a
 weakness in the state of Cohesion.

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23
of the simple solids.

By Lacity I understand a Defect of Firmness. Cohesion & Elasticity being given, & arises from an Excess of fluid matter in the Solids w^{ch} destroys their Firmness without lessning their Cohesion. By Flaccidity I understand a Defect of Elasticity. I believe it is seldom separated from Lacity, but we shall consider them as different.

Diseases from Excess of Cohesion Elasticity & Flexibility are: too much Rigidity when Flexibility is destroyed is: indeed too much Elasticity. as they are never separated I include them both together.

(b) the Diseases of the hard parts are of 3 kinds: the hard Consistence remaining w^{ch} weakness of Cohesion.

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101 See Lord Anson's voyage round
the world.

of the simple solids ^{2th}

2nd Where the hard Consistence remains
th 1st Excess of Cohesion. 3rd Where the
Consistence in the hard parts is lost or
destroyed.

2nd We now come to enquire into y^e
remote Causes of these Diseases.

1st Debility. This depends (a) upon
a weakness of the Original Stamina.
(b) upon ^{want of} ~~the~~ nourishment or a
want of proper Assimilation - or Appli-
cation of nourishment (c) it depends
on Aliment y^e contains too little nutri-
tious matter, or y^e Abounds too much wth
Water (d) upon ~~various~~ vitiated nou-
rishment. Thus the Jaundice ^{ch} is: seems to
depend on Debility is brot on by vitia-
ted Aliment. This we prove from
old wounds ^(a) breaking out afresh

32
May not the Nickett - Scrophulade
depend upon this Cause? —

of the simple solids

25

th w: shows us how much the Cohesion
of the solid is destroyed ^a (e) it depends
upon Corrosive powers applied from
without th w: distinguishes this from
the last. Thus the matter discharged
from Cancer induces a Tranquility
in every part it touches. (f) it de-
pends on too much Extension called
by Dr Gaubius "Distensio Rupturae
proxima" (g) upon a Loss of some
of the Fibres th w: connect the solid.

Thus an artery when ~~where~~ one of
its coats is broke. is said to be in a
state of Debility (h) upon a Diminution
of the weight of the air. all these
Causes of Debility are attended w: th Vacuity.
(i) Debility th w: Tranquility depends upon
moisture being dissipated from parts

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2.nd Laxity. This is distinguished from Debility as it is lost or rather by Excess than Defect of Motion. The remote Causes of Laxity depend (a) upon y Original Stamina of the Constitution which determines the Fibres to be more lax in some Persons than others (b) upon abundant watery nourishment, (c) upon a want of the drying power applied to the Fibres. Solids become such by an Abstraction of Humidity. When this is not Abstracted a Laxity will be induced. Exercise is the chief of these Applied powers (d) upon the Application of relaxing powers w: are 2, Heat & Moisture. Heat relaxes by resolving the consistent parts of the Solids. Moisture

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of the simple solids.

27

relaxes most powerfully especially when joined with heat. Dr. Terry Robinson found the relaxing power of cold water to be 35. I think ^e relaxing power of warm water may be fixed at 80. - But does moisture penetrate beyond the Cuticle? - I much doubt whether warm water insinuates itself beyond it. it is absorbed & circulates thro' the Lymphatics & may thus act on the whole body like Drops of Humidity introduced by the Mouth. Hence we see the Absurdity of those Medical Authors who talk so much of the relaxing power of Moisture. it never can enter ^e solids immediately, and it relaxes only in a secondary way, by being poured into them from ^e Mass of circulating Fluids.

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of the simple solids

3.^d Lacidity. the Remote Causes of this Disease are (a) those Causes of Lacidity ^{ca} introduce moisture into y: Fibres.
(b) too long Rest in an extended state
(c) too much vapour Oil or Water introduced into ^{the} cellular membrane more especially the last.

4.th Rigidity. depends (a) upon the state of the Original Stamina. (b) upon Abundant nourishment in Quantity Intensity & Application (c) upon constricting & condensing powers applied. the most powerful of these is Cold especially when it is excessive. hence we see how ~~much~~ it limits the Growth of Men & other Animals in very cold Climates.

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of the simple solids

But Rigidity is not always proportioned to Cold, for the retained Perspiration by its moisture counteracts the constricting powers of cold. exclusive that likewise by dissipating moisture induces Rigidity.

✓ Cohergent Medicines are said to bring on Rigidity, but Dr. Robinson found ^{the} solution of Alum & vitriol rather relaxed than contracted the Fibres he used. in y^e human Body they constrict only by acting on the solidativa or nervous System.

(d) upon too much Rest in a contracted state.

(e) upon every degree of Tension within y^e point of breaking.

(f) Rigidity in the Organized parts of the Body depends upon Compression especially in the Cellular Membrane. It is owing

+ adhesion

of the simple Solids

30

to this \dot{y} . Our Solids are acquiring strength
in the progress of Life

(G) Rest in a contracted posture. I speak
of her of Rigidity induced by \dot{y} cell Substance.
i. Rigidity will be bro't on when the
Solid parts are deprived of intervening
Fluids. hence the Accretion of \dot{y} ^{cell} ~~large~~
to the Plasma, & of the Guts to the Arteries.
the Evacuation of Coagulable
Lymph forms the connecting Medium.

k. Rigidity is in the last place bro't
on by such an Extension as gives Occasion
to a new Growth.

To all this we may add a Rigidity in-
duced when all kind of Softness is destroy-
ed as in the Case of Ossification.

I shall now proceed to be-
lieve of the naturally hard parts.

of the ...

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of the simple Solids

These are subject to three kinds of Diseases.

1st When Cohesion is destroyed, & a tender Fragility induced. does this depend on the Bones being Heterogeneous Masses & upon one of their constituent parts being washed away? I think not.

— It rather seems to depend upon corroding powers applied to them which erode them. w: is the nature of this corroding matter? we cannot tell. we can only say that there appears to be different species of it th w: we may infer from the Venereal & the Puer Perit. & the Scrophulous Caries differing from each other.

2nd When Flexibility is ~~is~~ so destroyed ^{& Bones} _{ing as y^r} they break easily. it is hard to tell when this occurs. it is a

12) Accidents such as Falls likewise
happen often in winter than in summer
from the ground on which we walk being
more slippery. —

of the simple solids.

Disease incident to old People ^{is} is owing to the Quantity of bony Matter increasing by age, ^{from} by a diminution of the water & Oil ^{is} are necessary to give the bones a due Flexibility.

- Dr. Gaubius takes notice of a Fragility in the bones ^{is} w: takes place in winter, ^{is} he infers from Fractures happening oftener in that season. But this cannot be true. no Cold can reach the bones without destroying Life. the generating power of Heat in the system overcome the Action of the most intense external Cold. the Fractures ^{is} w: occur in winter may be rather imputed to the Muscles acting th w: more force upon the bones than in summer. ^(a)

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of the Simple Solids

3 The Bones are liable to a Disease
 when they lose entirely their solid
 Consistence. in all these Cases ^{the} fire
 of the Bones is diminished. It may
 depend either on Acrimony applied
 to them ^{or} I think rather improbable.
 - or upon mild dissolving powers ^{or}
 do soften them as to make them
^{more} easily absorbed & into the System.
 This I think the most probable Opini-
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of the nervous System.

a Knowledge of the Functions of the Nerves is of the utmost Importance not only in the Physiology but in the Pathology as you will see more fully hereafter. All our Motions both Vital & Animal depend upon them. therefore I hope you will excuse me if I dwell a little upon them, & endeavour to illustrate some of their Functions.

To the nervous System belong the Brain Cerebellum the Medulla Oblongata - & Spinalis. it comprehends likewise the nerves ^{or} w. are distributed to every sensible part of the Body.

- The Extremities of the nerves are all

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connected wth two sets of Organs viz those
of Sense and Motion. Under the Head of
Sense I do not mean to treat of all
the senses, and the manner in w^{ch} Sensations
are communicated to the Brain by them,
nor under the Head of Motion do I pro-
-pose to treat of the Force of Muscles &c.
- these are equally foreign from our sub-
-ject. - The whole Phenomena of the
Nervous system may be reduced to
1st Impression, 2nd Thought, & 3rd Contraction.

- do all these Phenomena depend upon
Motion? I am far from asserting it.

- The 2nd is not the property of Motion but
depends ^{upon} ~~the~~ Spirit or soul or some im-
-material principle. But I affirm that

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of the nerves

it never can exist without Motion, & is without Impressions communicated by the Organs of Sense or Motion, according to the Maxim of the School "nil est in Intellectu quod non prius fuit in Sensu".

of Impression

The Term as here used is confined only to the Action of those Bodies ^{wh} are ~~com~~ made on the nervous System. it comprehends 1st all we can discover in external Bodies ^{2nd} ~~is~~ relative to Cause 2nd it comprehends the Motion excited in the Extremities of the nerves. 3rd it comprehends ^{the} Motion ^{wh} is propagated from ^{the} Extremities of the nerves to their Origin. I here make no Distinction between the Organs of Sense & Motion, as Impressions operate equally upon them both.

(as the word Mental Impressions
are improper, as the Operations
of the Mind we here speak of are
no ways connected wth Impressions.

Impressions are divided into two kinds
 1st Corporeal & 2nd Mental. All the 1st are
 those w^{ch} are made by matter on y^e body
 the 2nd are those where ~~motion~~ Thought is
 produced without any manifest Motion.
 All our sensations are either direct or
reflex. The direct are such as found Growth
 & excite on the mind. The Reflex are
 such Impressions as are attended wth plea-
 sure or pain, & are more purely mental.

I shall here speak only of those
 Impressions y^e are Corporeal as these
 can be more distinctly marked. I shall
 not confine this kind of Impression to the
 external surface of the body, but to
 all those things w^{ch} operate within y^e
 body especially such as are extraneous
 such as worms. Calculi &c. I shall

(a) These are not to be called Impression
as ~~they~~ they arise only from $\frac{2}{3}$ of state
of the Organs

extend their corporeal Impressions to such
as are excited by the blood, for we shall
find y^t Dreams & Deliria depend upon
its different states in the brain. You see
these corporeal Impressions naturally
divide themselves into 1st External and
2nd Internal. There are certain ^{sensations} ₂₀₀₀
excited in the mind from want of
Impressions such as the disagreeable ^{sensations}
arise w^h arise from silence or Darkness.
- Impressions will depend upon y^e diffi-
erent states of our nerves. Thus that a Cold
produces sensations according to y^e Degree
of Heat & Cold in our bodies. There are
sensations excited in the mind w^h do even
arise from the action of bodies exte-
rially ^{on} the nerves. This is a Distinction of
Importance, & sh^d be often attended to.

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I shall now speak of ^{the} diff^{er}ences of
of external Im^{pressions} ^{ones}; they are of 5 kinds ac-
cording to the Distinction of most ^{of} Philo-
sophers. Sight - taste - ~~hearing~~ ^{hearing} & hearing
are all alike in the sensations excited in
them. all the Other sensations are refer-
red to Touch but I think improperly,
for this sense is too extensive & too
much divided to be reduced to One
name, both externally & internally,
Thus the Glottis ^{the} is affected wth every
thing ^{the} comes in contact wth them.
^{the} ~~the~~ Air. the stomach is affected wth
a stimulus ^{the} produces no action on ^{the}
Eyes & vice versa. Does not this furnish
some suspensions of specific ^{Stimuli} ~~causes~~?
all sensations are communi-
cated by a Subtile Ether wth the Vacuum

can this suppose too y^r the nerves must
be always stretched in order to suffer
this inelastic fluid to pass & re-pass.
now this we know is not the case.

— That sensation cannot be communicated
by the nerves as these Elastic cords is a
supposition too absurd to be insisted
on.

of the nerves

40

Newton first hinted at. This Fluid
is not an aqueous inelastic substance as
Dr Boerhaave has supposed, for it
~~was~~ such a fluid never could be fit
for the velocity & frequency w: we ob-
serve in pulsation. (21)

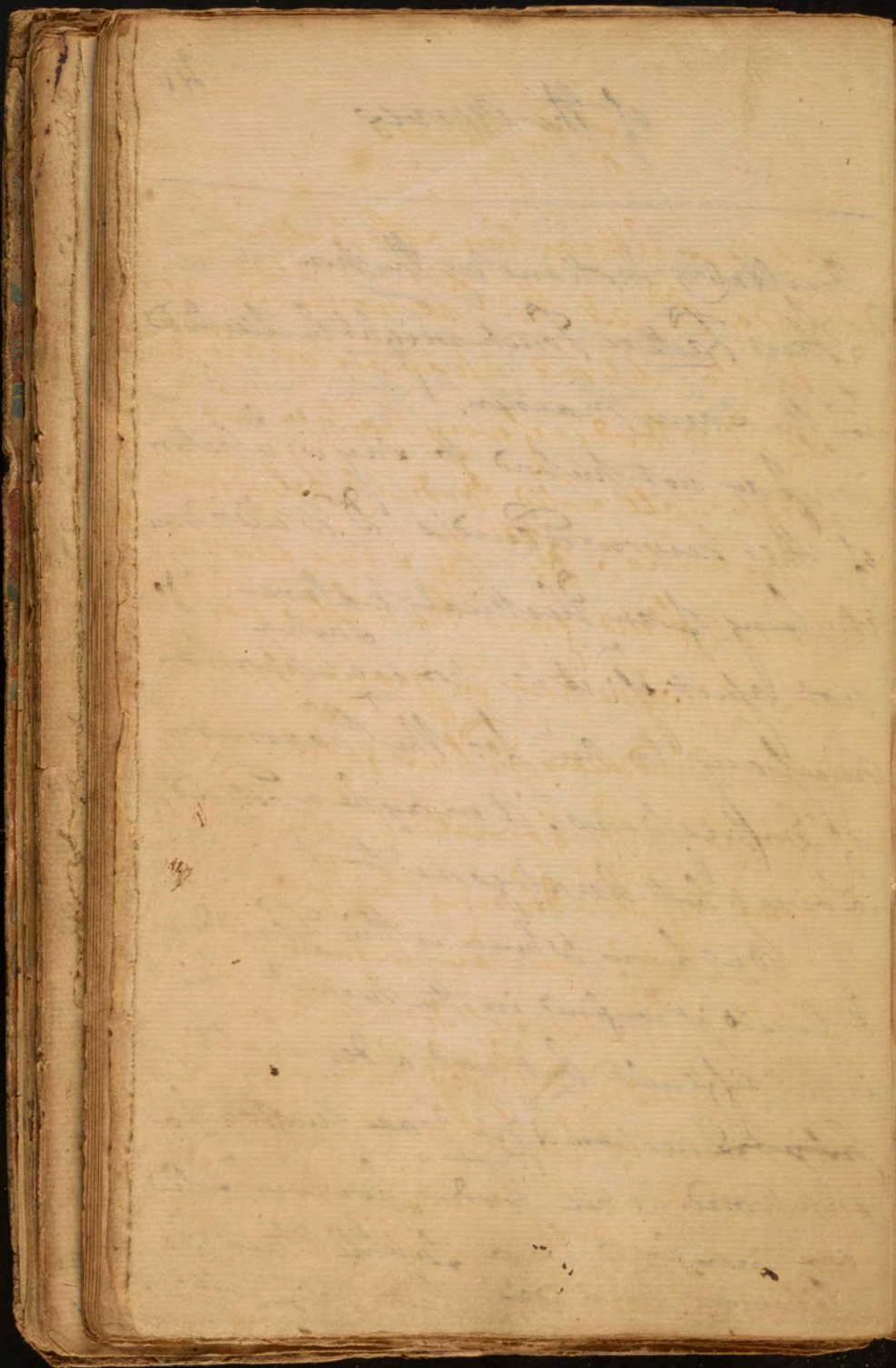
Vision depends upon ~~an~~ Oscillatory
motions excited by the Rays of Light
Hearing depends likewise upon certain
Oscillation excited on the Auditory Nerve
by tremulous motions in the Air which
arise first from a tremulous Oscillatory
motion excited in the sounding body
Smell may be accounted for in the
same manner from elastic vapours
floating in the Air which produce

As the Variety in Smells depends
on the Mixture formed by from the
floating Body & the Vapor in Nose.

Oscillatory Motions in the Nerve. &
Thus Facts & Facts might be illustrated
in the same manner.

I do not pretend to say w^h y^r nature
of this nervous Fluid is. Dr. Waller denies
its being of an Electrical nature. I do
not assert y^r it is, nor is a ^{supra}supposition
necessary to acc^t for the Phenomena
of Impressions. it may be a Fluid
somewhat analogous to it.

But from whence is this Fluid derived
& how is it confined in the Nerves? This
is a difficult but not a desperate
~~subject~~ Question. Mr Isaac Newton has
supposed y^r all Bodies however solid
are enveloped wth a Subtile Ether w^{ch}
likewise pervades them, & on this



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of the Nerves

he supposes Attraction & Repulsion
 depends. 2.nd all the Phenomena of
 Electricity depend upon a subtle fluid.
 - all fluid bodies of every nature are non
 Electrics. all Solid Bodies (Metals excepted)
 are Electrics. 3.rd The same subtle
 Ethereal fluid gives the whole Pheno-
 mena of Magnetism in Iron. Now may
 not the Medullary Fibres from their
 Original Conformation have a subtle
 Ethereal Fluid adhering to them like
 the magnet? we are acquainted only
 wth the vibrations of Air, but as the
 Ether according to Sir I. Newton's Opinion
 is millions of times finer. So he supposes
 y^t its vibrations may be carried on
 wth millions of times greater velocity.

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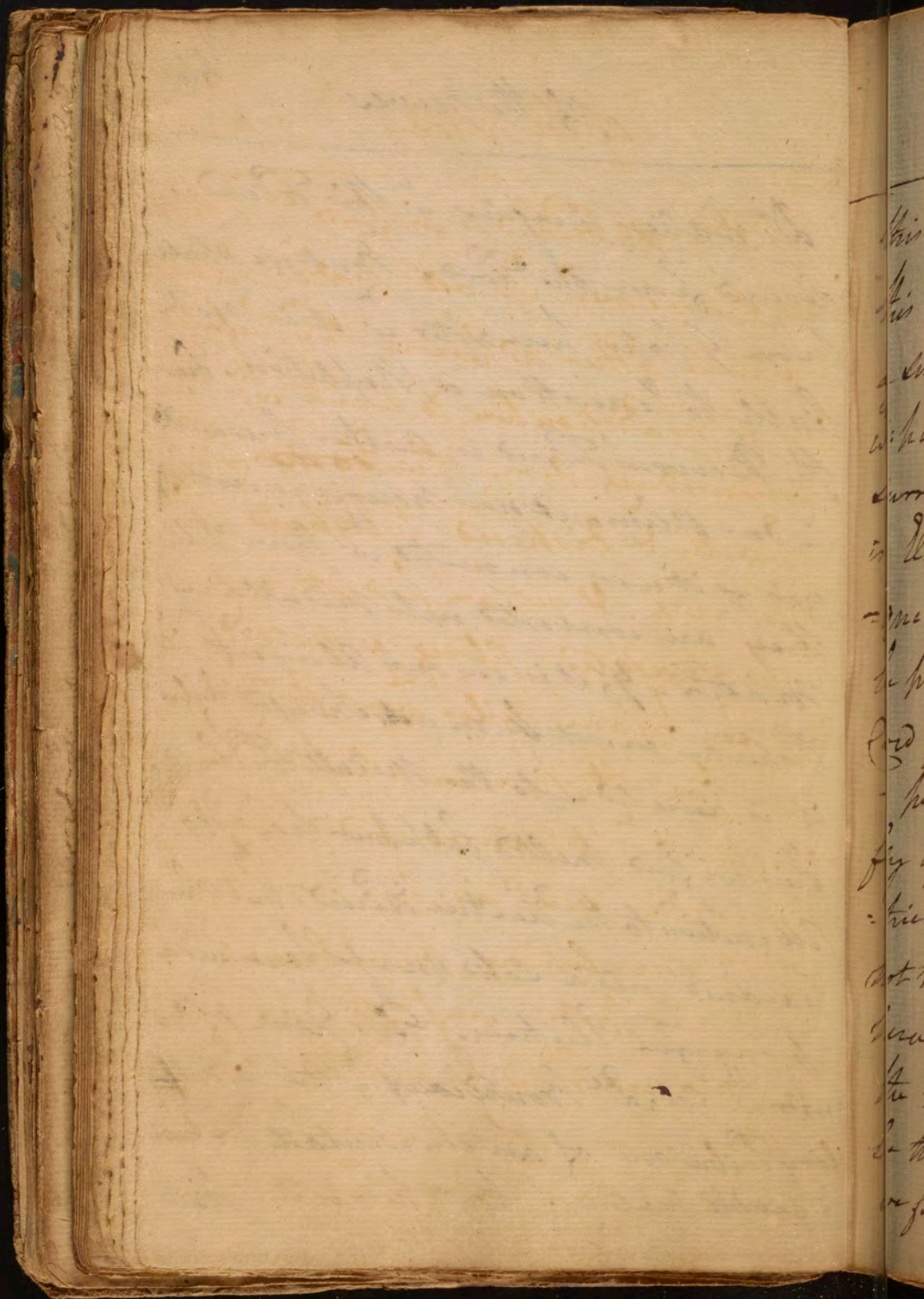
Plants have been found to be possessed of Irritability. This can only be by means of some subtle Aetherial Fluid.

- From all this we may presume such a Fluid is in the nerves. we don't pretend to say it is analogous to any of the Fluids we have mentioned. it is different from them in some things, as Dr Garbino supposes.

But from whence comes this Fluid in our nerves? - here let us have recourse to Electricity. we find some Bodies have a power of accumulating it, Others again propagate it as soon as it is thrown in them. thus we suppose the nerves ~~Fluid~~ to attract it from all the surrounding Bodies.

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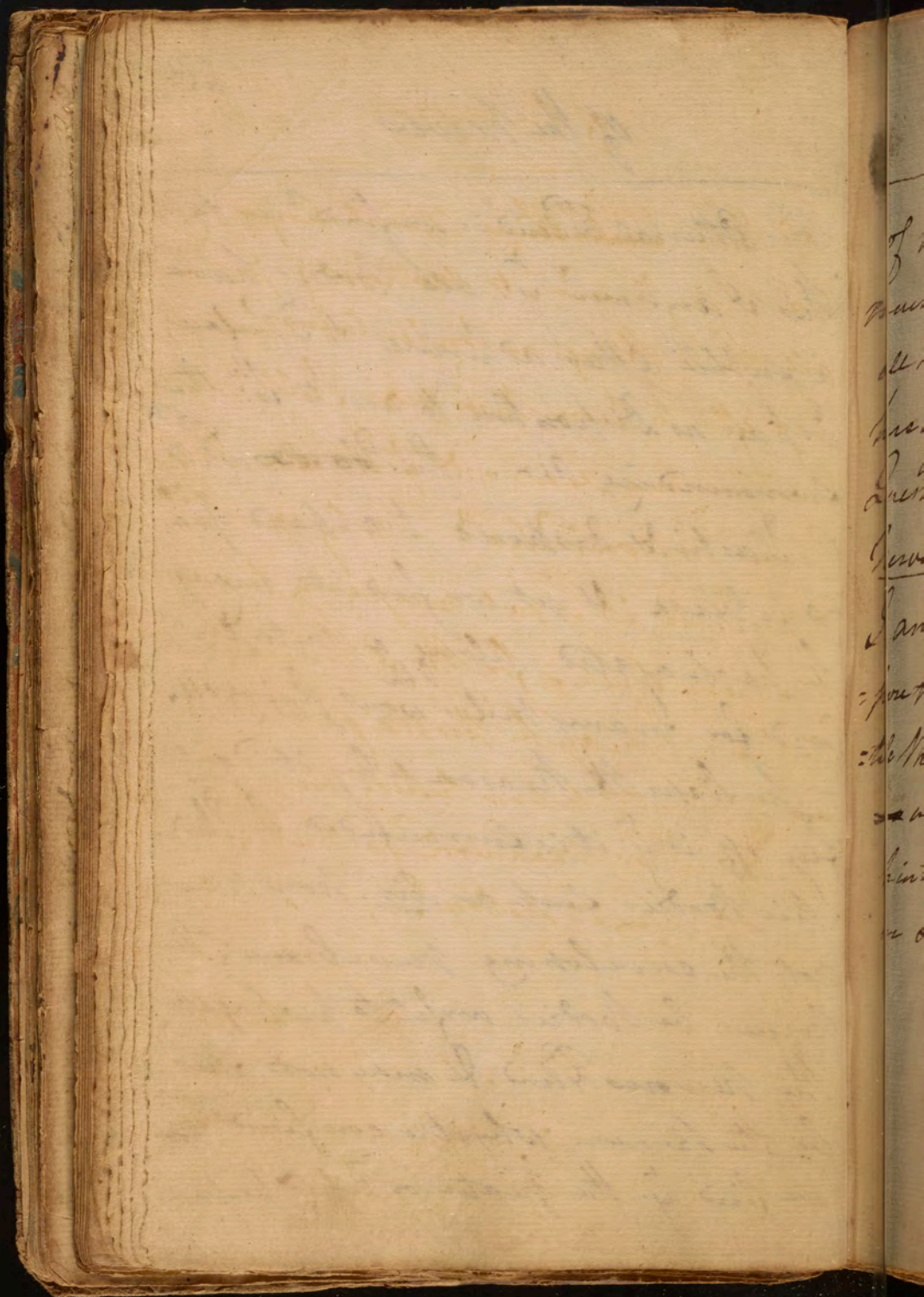
D^r Haller imagines γ : this Fluid is derived from our Food. But we shall prove γ hope hereafter γ : it is not liable to Exhaustion or Repletion. For the Nervous Fluid is neither present in our Aliment nor nourishment, nor is it ever connected wth them till they are converted into Medullary Matter. If it is in our Aliment its Properties must be much changed before it is secreted into the Medull^l Fibres. Thus we find melted sulphur has no Attraction to the Electric Fluid, but when hardened into a solid Mass becomes a powerful Electric. For James of Br^usson ^{the} M^r: de Bourdeaux γ : the Medull^l Fibres are of an immutable unchangeable nature. But how is it that



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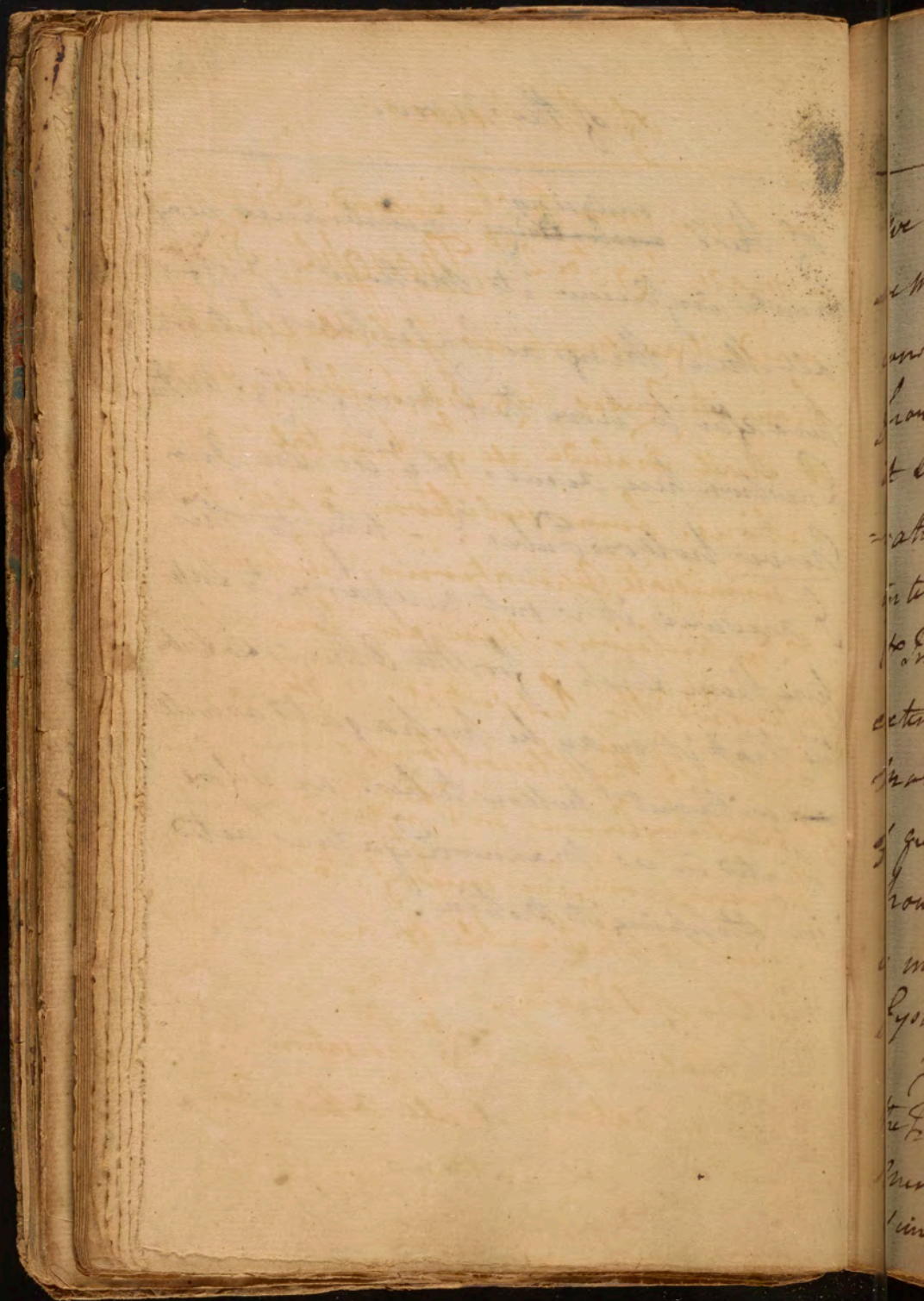
of the Nerves

This Ethereal Fluid is confin'd? - to
 this I answer y: all Bodies have
 a subtle Ether adhering to y^r surface,
 w^h has no Disposition to unite wth the
 surrounding Air. this ~~Partic~~ Fluid
 is Elastic & disposed to expand Qua-
 -que Versa, & yet we find it may
 be propagated along a metallic
 Cord for many Miles wout flying off.
 - perhaps the Reason why it dont
 fly off is y: it is surrounded by Ele-
 -tric Bodies such as Air. Now may
 not the enveloping Membranes of the
 Nerves be Bodies unfit to propagate
 the Nervous Fluid, & may not this
 be the Reason why it is confin'd? For
 we find y: the greater or lesser prepare



of the Nerves.

of these ^{enclosing} ~~enveloping~~ membranes very
 much influence its motions. I offer
 all these things as Conjectures but hope
 hereafter to prove them more fully. Another
 Question here occurs & y^t is Are our
Nerves hollow Tubes? - Why to this
 I answer it is not necessary to sup-
 pose them such. for the other is so sub-
 tile that it may be propagated as well
 without hollow tubes. we before
 hinted in w^t manner Ligatures acted
 in stopping its Motion.

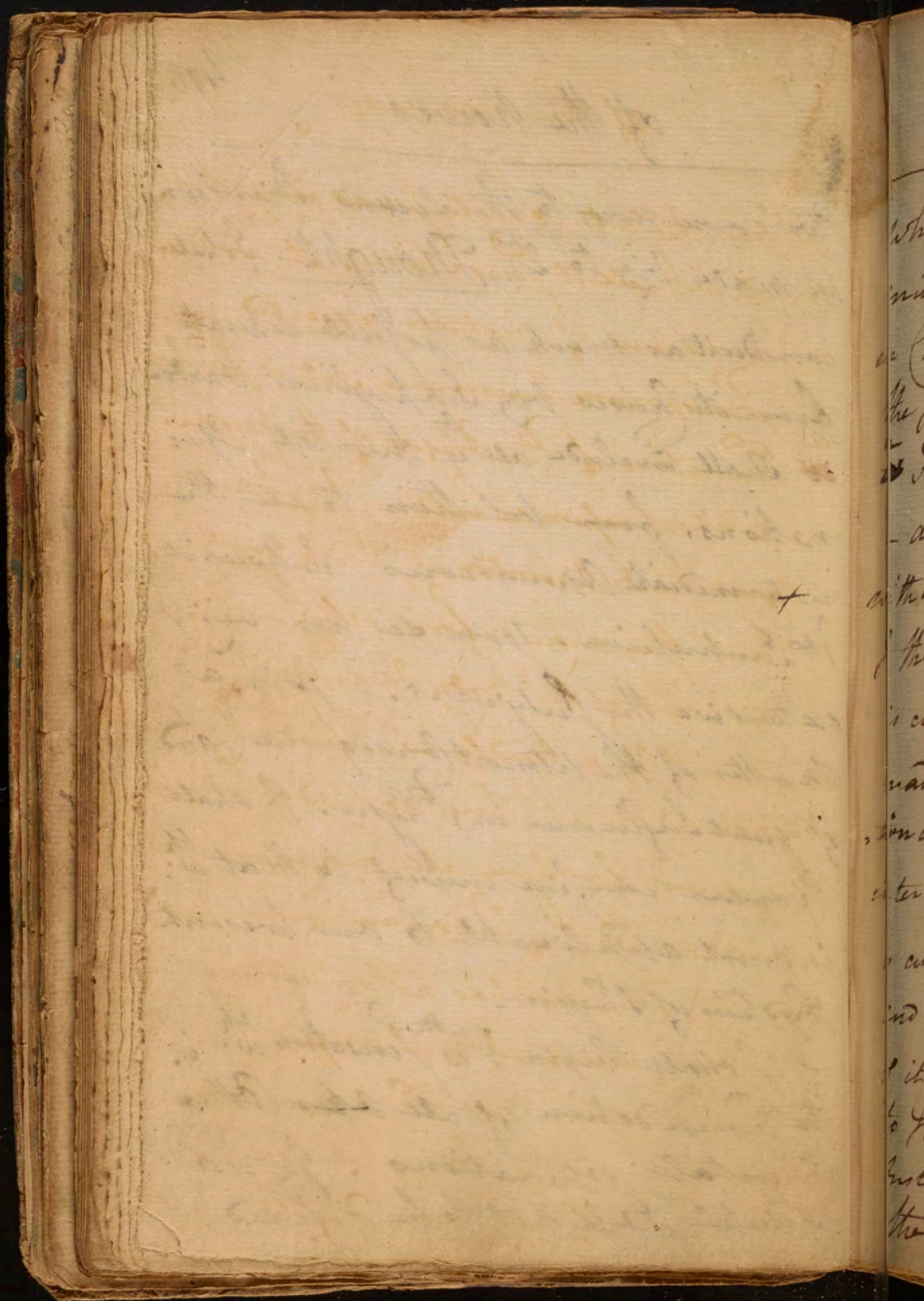


of the Nerves

47

we come now to the Second Division
we made viz to 2nd Thought. I shall
consider it as much as possible separate
from its Causes viz Impression, & under
it shall include all y^e Mental Oper-
ations, from Perception to all the
intermediate Operations between it
& Impression. You see how very
extensive the Subject is! - It is a
Matter of the utmost consequence, and
of great Influence in Physic. I shall
however confine myself to that w^{ch}
is most applicable to our present
System of Physic.

I shall begin wth sensation w^{ch} is
the Foundation of all ~~the~~ Other
Mental Operations. It is a
simple Idea not to be defined.



When Objects excite Ideas in our mind we call it Sensation. it arises in consequence of motion excited in the Sensorium Commune. it is therefore a Function of the Origin of the nerves.

- do Impressions excite Contraction without the Intervention of Sensation? yes I think they may. for 1. when a muscle is cut out of the body & an Impression made on ^{it} by a needle we find a contraction excited on it. here no kind of sensation intervenes, for here all communication is cut off wth the Sensorium Commune, and the animal has no consciousness of it, & consciousness is always necessary to Sensation. But 2. we have other instances in the living bodies. Thus the Impressions made on the gutts

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by Purgers excite no kind of Sensation
in the sensorium until the Matter
buried off arrives at the Pectum.

Some here tell us of a Repetition
of this Impression takes off Sensation.

- In many Cases this may happen,
but in the Instance we have adduced it
has no Foundation for it takes place
even in the first purge we give. Iw?
ask here who ever felt a Sensation from
the Operation of Diuretics? or even
Impression. Yet we see an Evident
Contraction take place ^{wh} cannot be
resolved into Habit. Cantharides it is
true excite Sensation, but they operate
on the neck of the bladder, & not on
the Kidneys.

Another Question occurs here

101 for the Contraction is excited
by a motion communicated thro' the
Sensorium commune

we see ~~how~~ ^{how} ~~concomitant~~ ^{concomitant} y^e Contractions are
 excited in places no way connected
 by nerves or muscles wth the place
 where the Impressions are made, Now
 are not these Impressions accompa-
 -nied wth Sensation or Thought? ^(a) No
 they are not. I have seen a Stone
 in the Kidneys excite Sickness &
 vomiting & yet the Patients never
 felt the least Uneasiness in their
 Kidneys. many other Examples of the
 same kind might be adduced in those
 Cases w^{ch} are called Sympathies. Sensation
 is connected wth Impression only for
 the final purposes of alarming
 us by pain or alluring us by
 Pleasure.

I shall now go on ^{to} take notice

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of the Nerves

of those Impressionsth do excite Sensation. Our Sensations are different according to the nature of Impression, as in the sense of hard & soft &c. They are differentth 2: according to the nature of the Organ they are made on. This may depend on (as the Extremities of y: Nerves being diversified, or ~~C~~ upon the state of the Organ in which they terminate. Thus we may conceive the Auditory Nerve w: receive the Light if placed in the Retina, & vice versa. 3: Impressions are different according to the nature of the sensation arising. There is no connection between Impression & Sensation. There is nothing in Colour y: gives us y: least Idea of their depending upon y: different Refrangibility of the Rays of Light.

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of the Nerves

See Dr. Haller's Principia § 556.

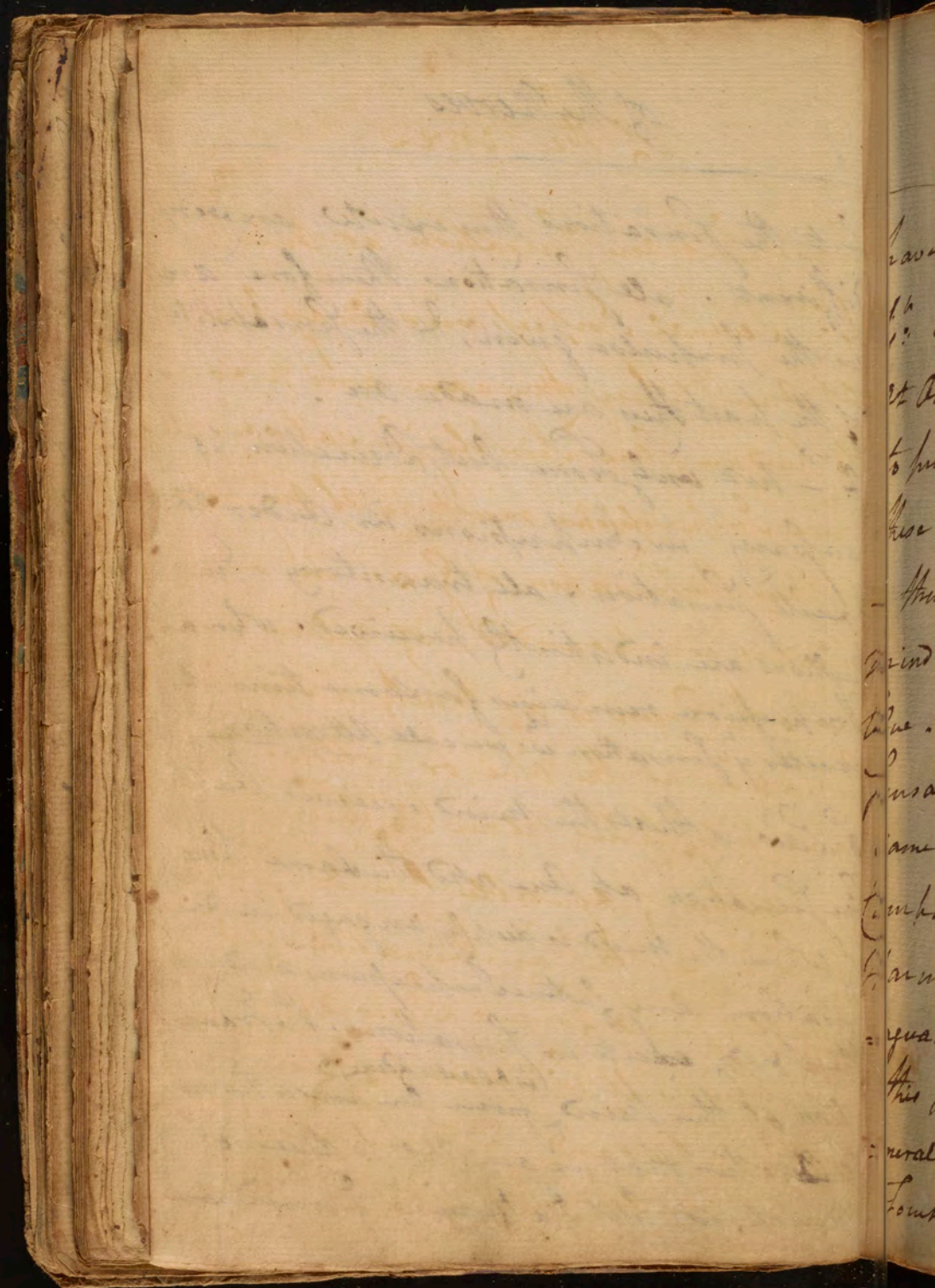
— This Observation is of the utmost Consequence as we here distinguish Body & Mind from each Other, and it is the strongest Argument in Favour of the Immateriality of the Soul. All our sensations you see depend upon certain arbitrary Institutions of our Creator. I see no Reason why the Refrangibility of the Rays of Light w^{ch} give us ² Ideas of a red Colour sh^d not have given us the Idea's of blue. *lic Deo visum est.*
^{3rd} the Laws of Limitation are
 1st all our sensations depend on impressions
 but they are remarkably connected wth the Degrees of Impulse, inasmuch as sometimes to change the sensations. Thus Heat & Cold depend on ^e same Impulse.

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but the sensations they excite are very different. all sensations therefore are as the impulse given, & the sensibility of the part they are made on.

2nd - not only Force but Duration is necessary in Impressions in order to excite sensation. all transitory Impressions are indistinctly perceived. when an Impression remains for some time it excites ^{it} a sensation w^{ch} we call Attention

3rd Law, is that the mind receives but one sensation at one and the same time. - when the mind is deeply engaged in one sensation, any future Impressions made on the Body excite no sensations. the Transition of the mind ^{is so sudden} from one sensation to another that we are apt to deceive ourselves. but I affirm y^t the mind can



of the Nerves

have but one sensation at once.

4th: Several Impressions may Operate at Once when they can unite so as to produce one simple sensation. all these Impressions must be of one species. — Thus the sensation of Green in our mind is compounded of yellow and blue. the Green is as truly a simple sensation as the blue or yellow. the same thing takes place in sound. the Combination of agreeable sounds forms Harmony. the Combination of disagreeable sounds forms Discord. I think this Law will likewise hold very general wth regard to the sensations of Touch — smell & Taste especially in

those of one kind. It is necessary in
all Cases of Impressions of this nature
that they be ^{or} synchronous - that
the Impressions be very minute - and
Duly mixed - 2^d all ^{sensations sh^d} ~~be~~ continue
for sometime after the Impression
is made. Now if an Impression is
made immediately afterwards, the Impres-
sions are compounded & a single sensation
excited. Thus if a Boy paints his Top
of a variety of Colours & whisks it, all
the Impressions on the Top will unite &
produce but one Sensation on y^e mind.

- This finishes our Acc^t of Sensation
I go on to Observe y^t they may be
renewed by the power of y^e soul called

(a) without this we never sh^d. become
acquainted wth nature, as every new
Impression w^d multiply our Ideas.

of the nerves

Memory. this is of two kinds: 1.st
 When the Sensation is excited by a
 Renewal of the Impression. This is
 called Reminiscence ^{1st} or 2.nd When
 the Sensation is recalled ^{the} without any
 Impressions which formerly excited them.
 - This sort of Memory is of two Species 1.st
 When the Idea is as vivid & distinct ~~that~~
 as it was in the Original Impression 2.nd
 When these Ideas are as strong & distinct
 as the Original Ideas themselves were.
 - This I distinguish by the name of
Imagination which renews Ideas so
 strongly as to make us imagine the
 Impressions to be present which at
 first excited them. — W.D. Hale 2599

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of the Nerves

Let us now enquire into the Causes of these Sensations. Why does Reminis-
-cence bring to our minds Ideas form-
-only excited there? an Answer to this
would lead us into very subtle Discussions.

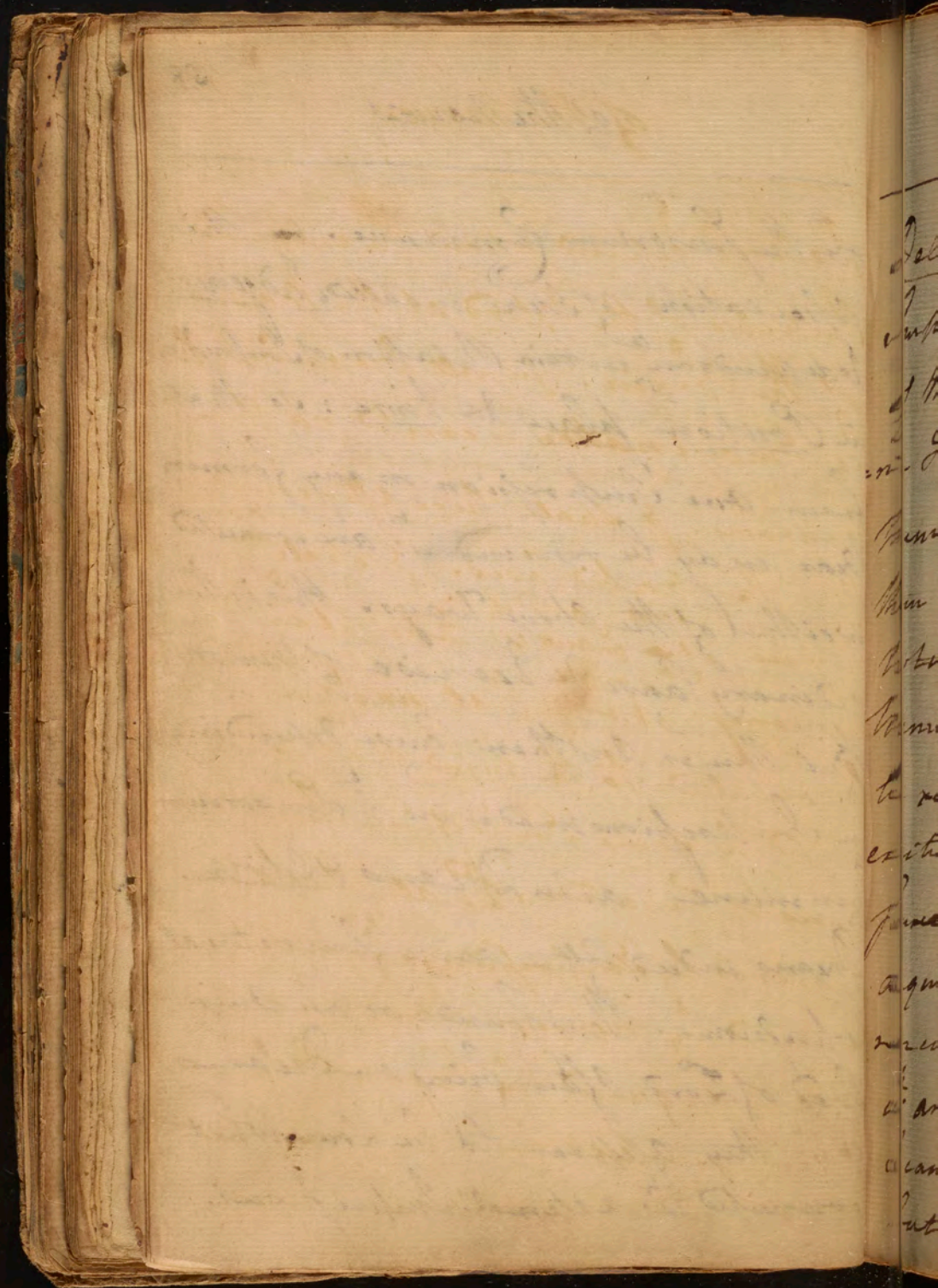
I shall only enquire into the
Circumstances th attend it. In every
Impression we have a complex th idea
inasmuch th in all Nature we never find
any two things alike, hence th mind
always enquires how far the Impression
resembles in all its Qualities th the Impres-
-sion it had before. W: is the Cause of
Memory & Imagination? It depends
either on an Association of Ideas
th W: a present external Impression on
upon internal Impressions made

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of the nerves

on the Sensorium Commune. in this Association of Ideas is called Judgement & depends on ^a certain Relation of Impressions in Position place & time: so that from one Impression many former Ideas may be renewed ^{y^e}: are connected in either of the above ways. This is the ordinary Cause & Exercise of Memory. But there is another Cause depending on Impressions made on ^{the} Sensorium Commune as in Dreams & Deliria.

Dreams indeed often arise from external Impressions. Thus sound, or an Over Load of Food often bring on Dreams, so y^t they appear to be somewhat connected th external Impressions.



Deliria depend upon the increased
Impulse of the blood at the Basis
of the Brain. in all Dreams Delir-
ia Imagination is excited rather than
Memory. I shall hereafter consider
them as morbid Cases. I shall take
notice of ^{some} Laws th take place in
Memory. 1. th That no Idea can
be recalled to the mind that was not
excited by some Impression from some
Source of Sensation. 2. th all the Ideas
acquired by Impression cannot be
renewed by memory. none but those
th are acquired by Hearing & Seeing.
I can recollect sounds & prospects,
but cannot recall the Ideas of

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Smell - Taste - or Touch - happy for
 as we cannot renew the sensations
 of Pain. the Ideas arising from smell
 or Taste can only be renewed by cer-
 -tain signs such as words or sounds
th w: have formerly been associated w:
 them. we only remember w: these sen-
 -sations were, & even sometimes feel
 the Effects of them as in thinking of
Ipecacuanha but in these cases we do
 not remember the Taste of Ipecacuanha.

It is by means of memory we dis-
 -tinguish between madness & sound sense
 & Dreaming & waking. For the waking
 man in his senses recalls his Ideas
 in y: Train in w: they had been asso-
 -ciated w: I would call Coherence in

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of the nerves

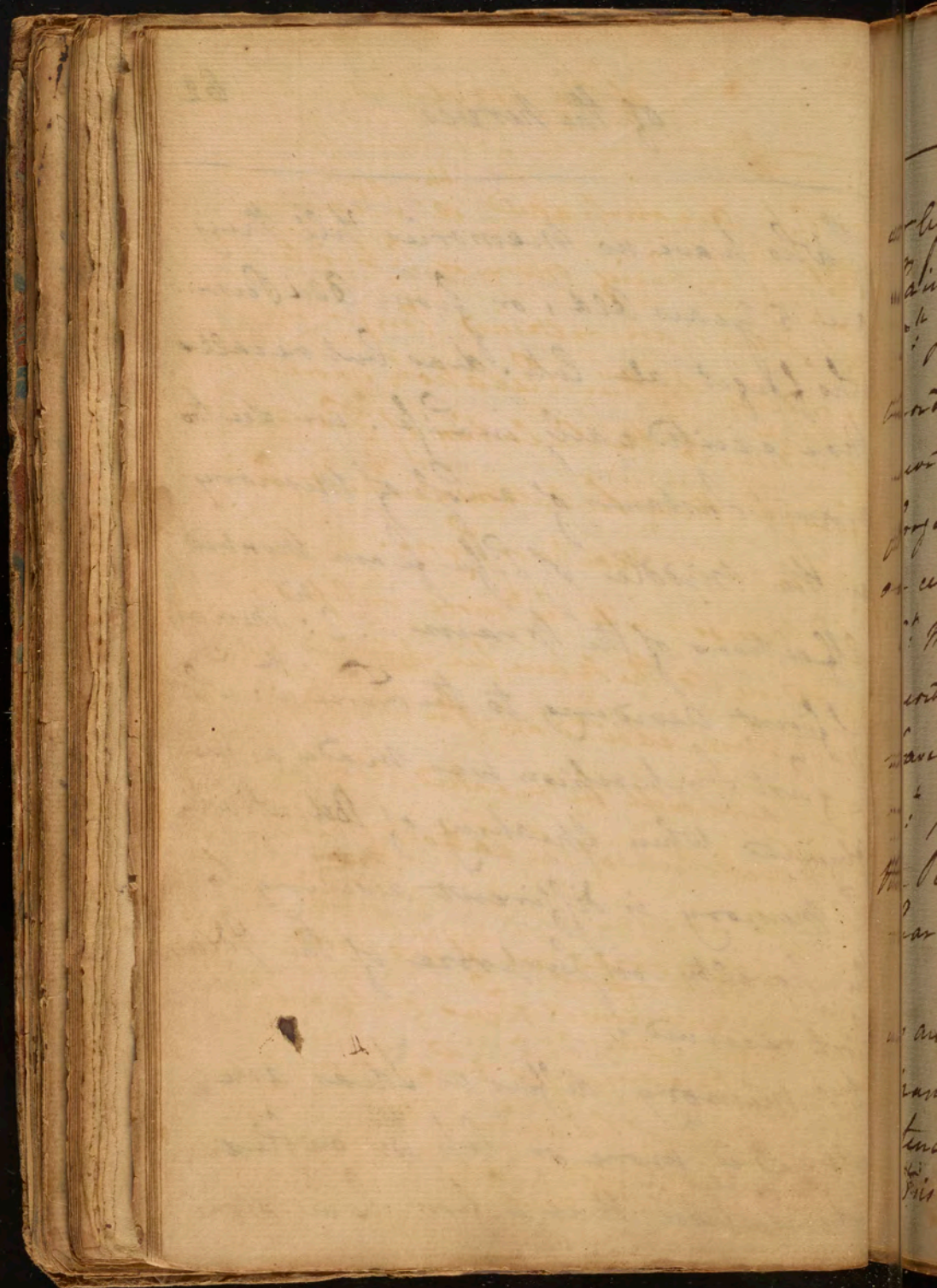
61

thinking. Thus when I am seated in
my own Chamber ~~and~~ when I recd.
-lect my having given a Lecture. I always
recall the Idea of this Chamber & of the
several Gentlemen ^{who} surround me w:
this Drap - visage - Employment &c.
Now in Dreams &c? this subject be-
cometh to my mind my Ideas w:^h be confused,
& &c? Perhaps ~~ing~~ ^{ing} imagine this
Chamber altered - the Gentlemen
who surround me ~~as~~ changed in th;
Drap - or visage, or perhaps employed
in a different manner than I now see them.

The different states of Memory
depend upon the state of Sensorium
Commune. Memory is seated in the
Brain. This is evident from Children

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 100. 100th

Who have no memories till they
are 5 years old, or from Old Persons
who forget all late Ideas, but recall
those excited early in Life. we see too
many Instances of a Loss of Memory
in the middle of Life from morbid
Affections of the Brain. 2nd Memory
is different according to the Form ^{to} which
the first Impression was made as we
observed when speaking of Attention.
3rd Memory is different according to
the novelty or surprise of the Idea
first received.
4th Memory differs as Ideas are
attended more or less wth reflex
sensation that is from being more



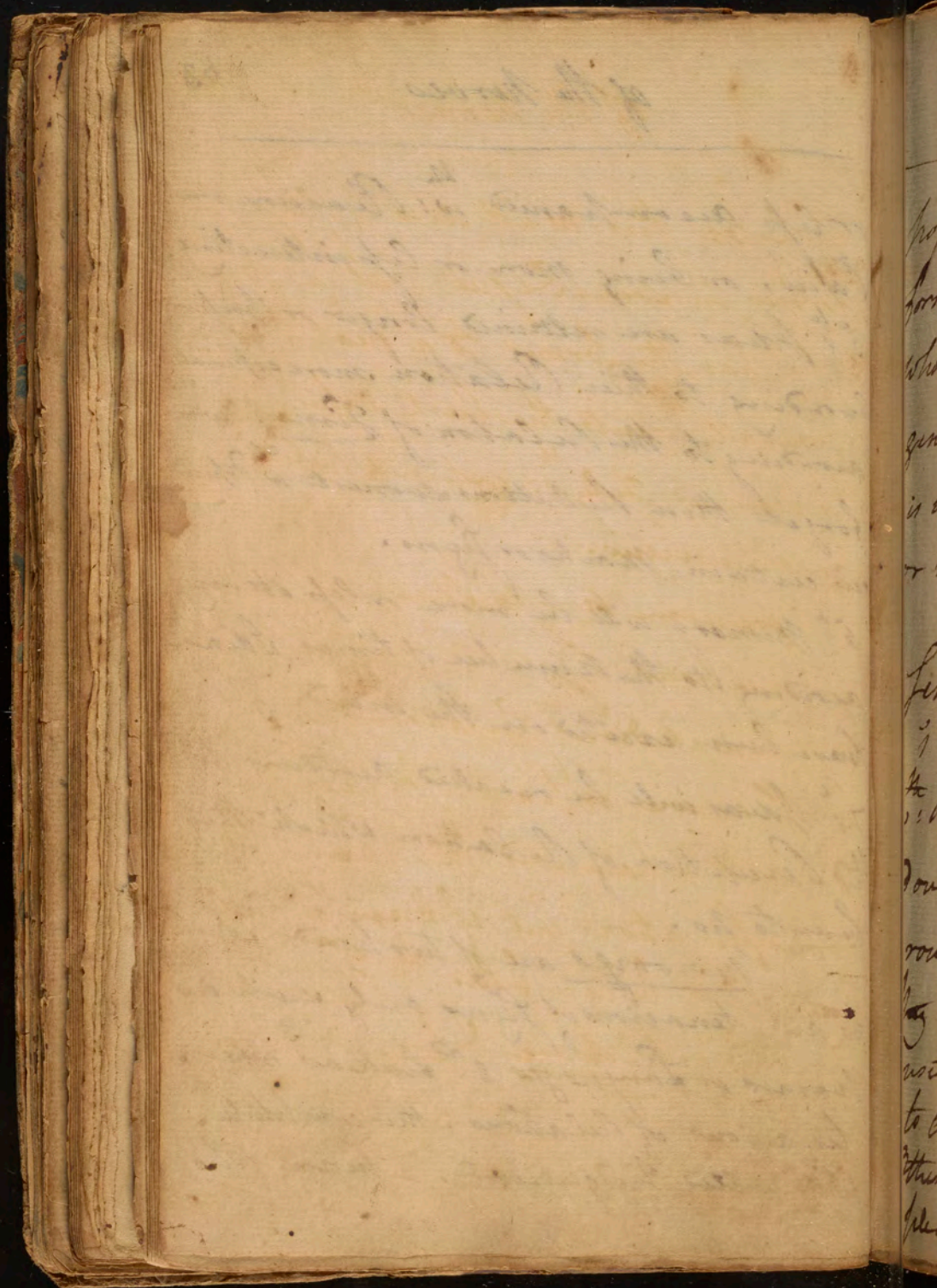
or less accompanied wth Pleasure or Pain, or being more or less interesting.

5th Ideas are retained longer or shorter according to their Relation more especially according to the Relation of Time. we forget those Relations soonest w^{ch} depend on certain Marks or Signs.

6th Memory will be more or less strong according to the Number of times Ideas have been excited on the mind.

7th Ideas will be recalled according to the Perception of Relation which they bear to us. —

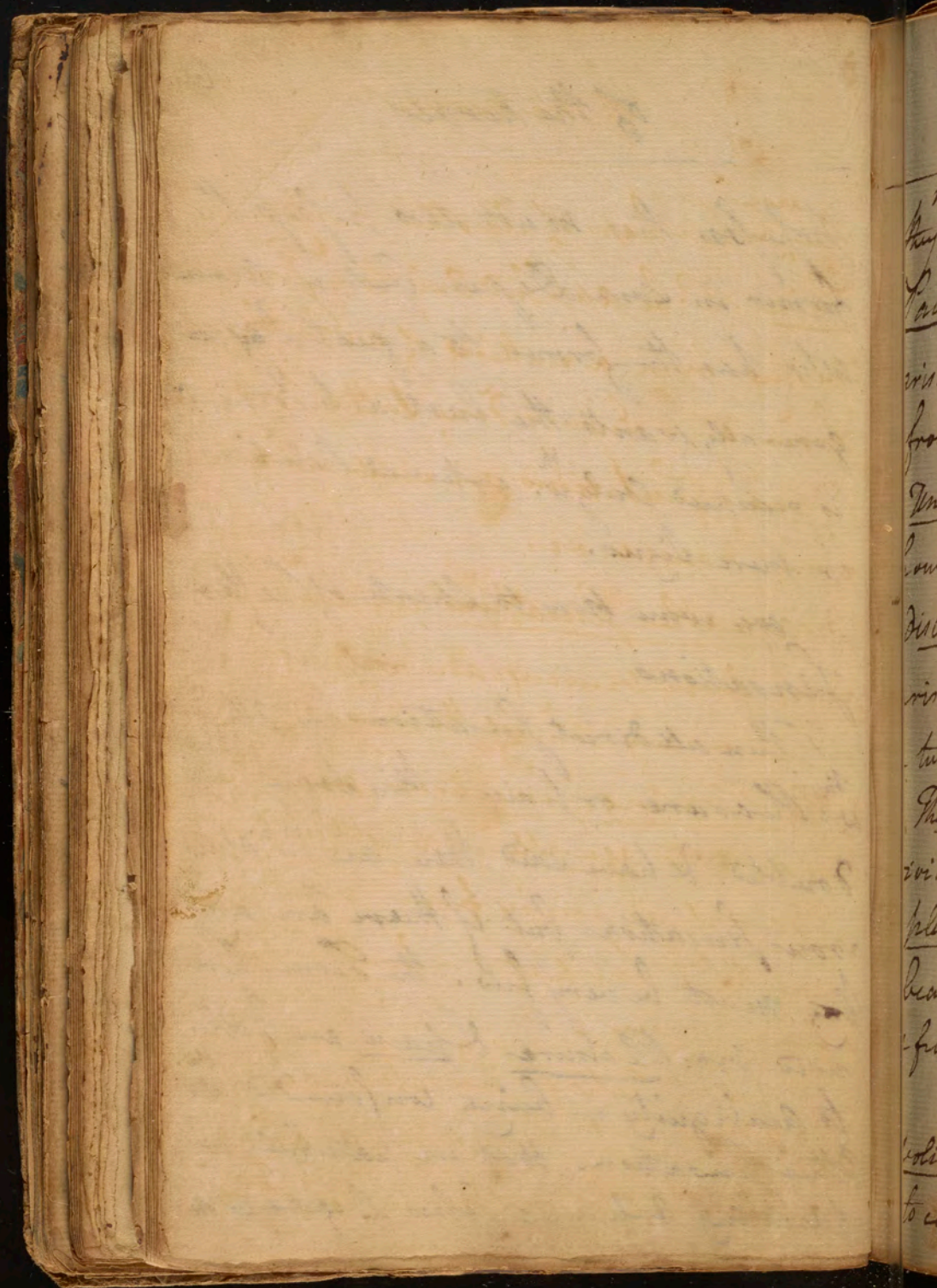
Memories are of two kinds; such as are tenacious of Signs only such as Names or Languages 2nd Such as are tenacious of Relations. this constitutes w^{ch} is called Judgement. a man who



possess this must also possess the former in some Degree, but a Man who has the former to a great Degree generally wants the last, as his Mind is occupied only wth external Relations or mere Signs.

we come now to speak of Reflex Sensations

i^t then all direct Sensations are attended wth Pleasure or pain. This some have doubted, & have said there are Adynamic Sensations but if there are any they must be very few. the Term here used viz: Pleasure & pain are liable to Ambiguity in being confounded wth other Sensations that are painful or pleasing only in a lesser Degree, or in



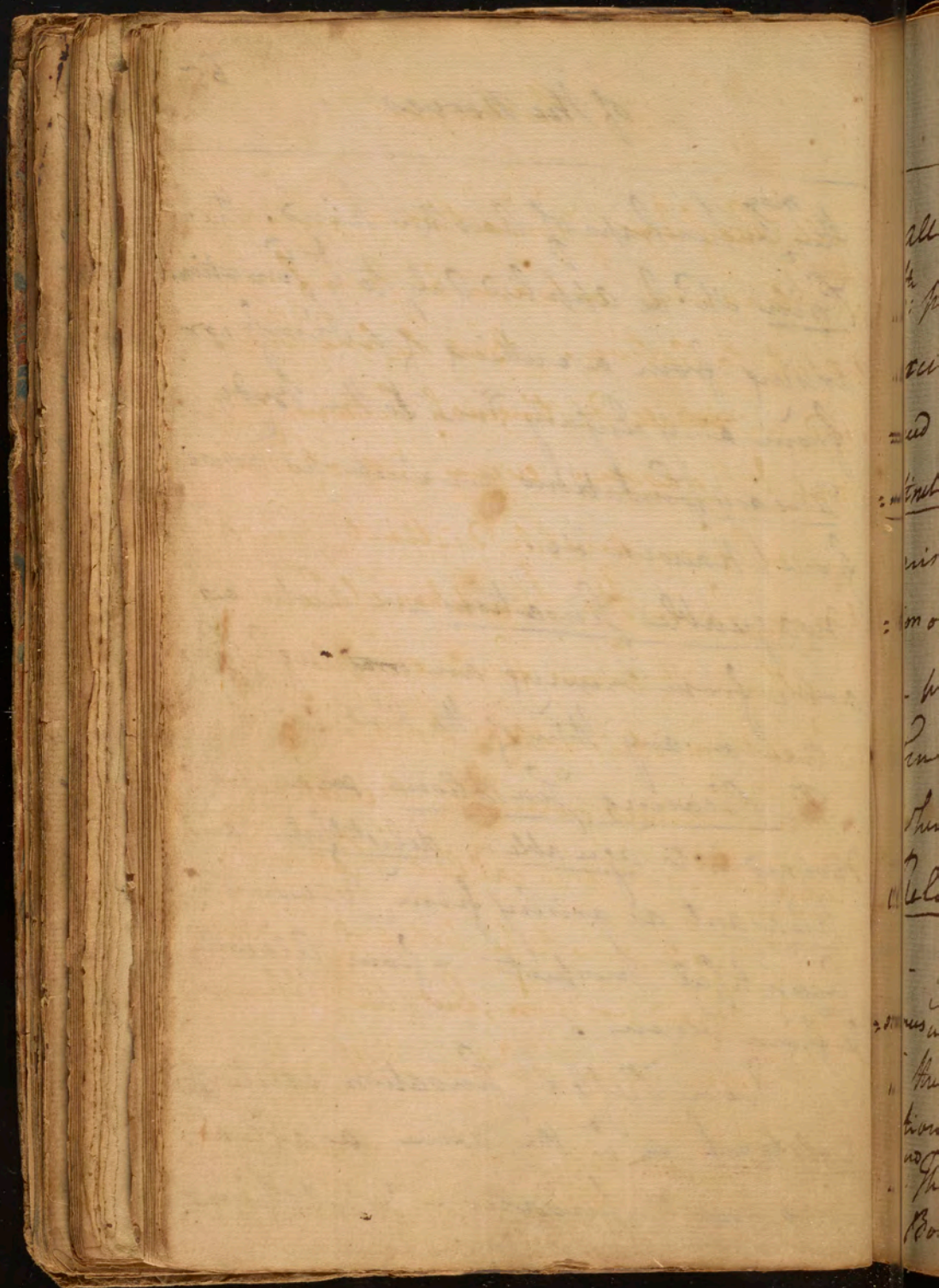
may be perhaps of Another kind. thus
Pain sh^d. be applied only to y^e Sensations
 arising from a cutting of a Knife, or
 from any Injury Done to the body.

Uneasy Sensations are such as arise
 from Chansia &c.

Disagreeable Sensations are such as
 arise from viewing an ~~very~~ ugly Pic-
 -ture or any thing of the kind.

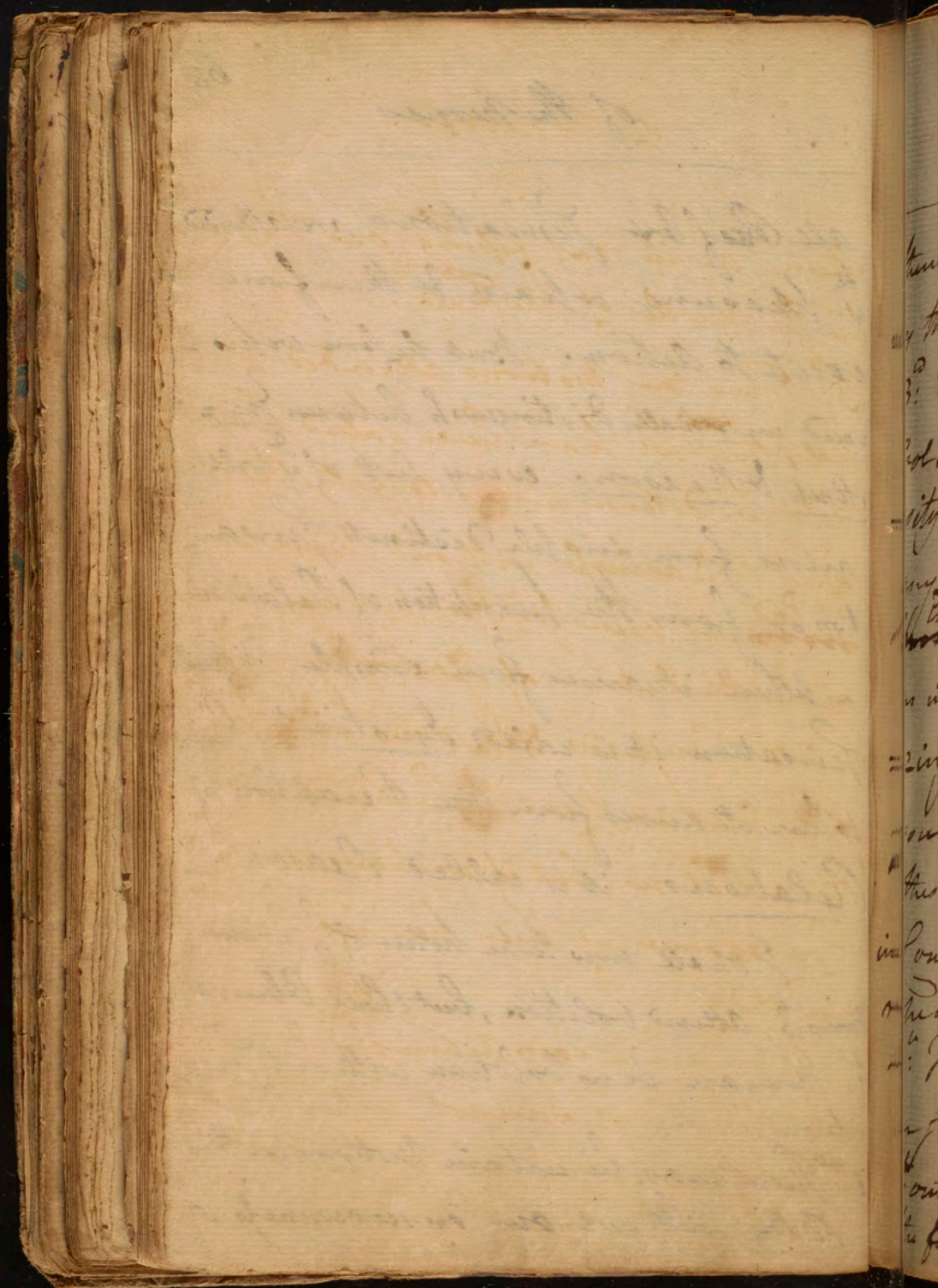
The Pleasing Sensations may be
 divided into agreeable - delightful, and
pleasant as arising from viewing a
 beautiful prospect - from Alacrity
 & from Beauty.

Every Reflex Sensation excites to
volition so y^t they serve as a chain
 to connect sensation & volition.



all Reflex Sensations are attended
^{to} wth pleasure or pain & therefore
 excite to Action. But before we pro-
 ceed we shall distinguish between Instinct & Reason. every Act of $\frac{2}{y}$ will
 arise from simple Distinct Sensa-
 tion or from the Perception of Relation
 - When it arises from simple Distinct
 Sensation it is called Instinct, But
 when it arises from the Perception of
Relations it is called Reason.

- I shall now take notice of $\frac{2}{y}$ Circum-
 stances ⁱⁿ w^{ch} Attendant volition, but I shall Observe
 1st There can be no volition without Sensa-
 tion,
 2nd There may be certain Motions in the
 Body without our Consciousness of



of the nerves

them as in expressing our Passions
by the muscles of the Face.

3.^d There are motions attended with
volition w^{ch} have been called Propens-
-ity w^{ch} determines us to get Rid of
any uneasiness without having any
~~End~~ ^{End} in view for this purpose. Such
as in the Action of Yawning - Sneez-
-ing - Coughing &c. Some will tell
you that we have an End in view in
these Actions, but if we have it is only
in consequence of their having been
repeated.

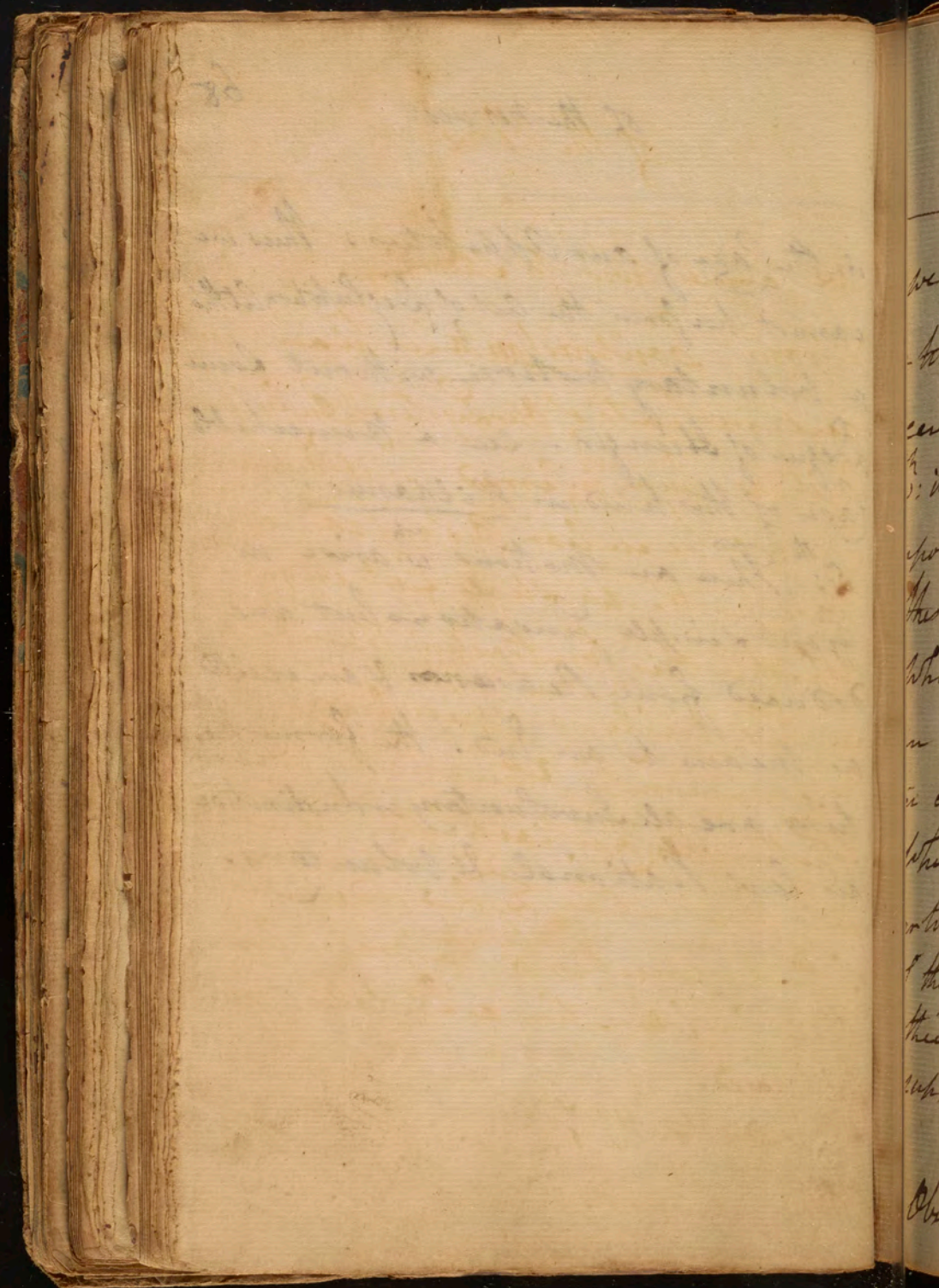
4.th There are certain Actions w^{ch} depend
on Stimuli y^t cannot be performed
wthout them. They are connected with
the former, & have no End in view. as

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in the Case of our Appetites. Thus we cannot perform the Act of Deglutition ^{Altho} a voluntary Motion without some Degree of Hunger. see a remarkable Case of this kind in Hildanus.

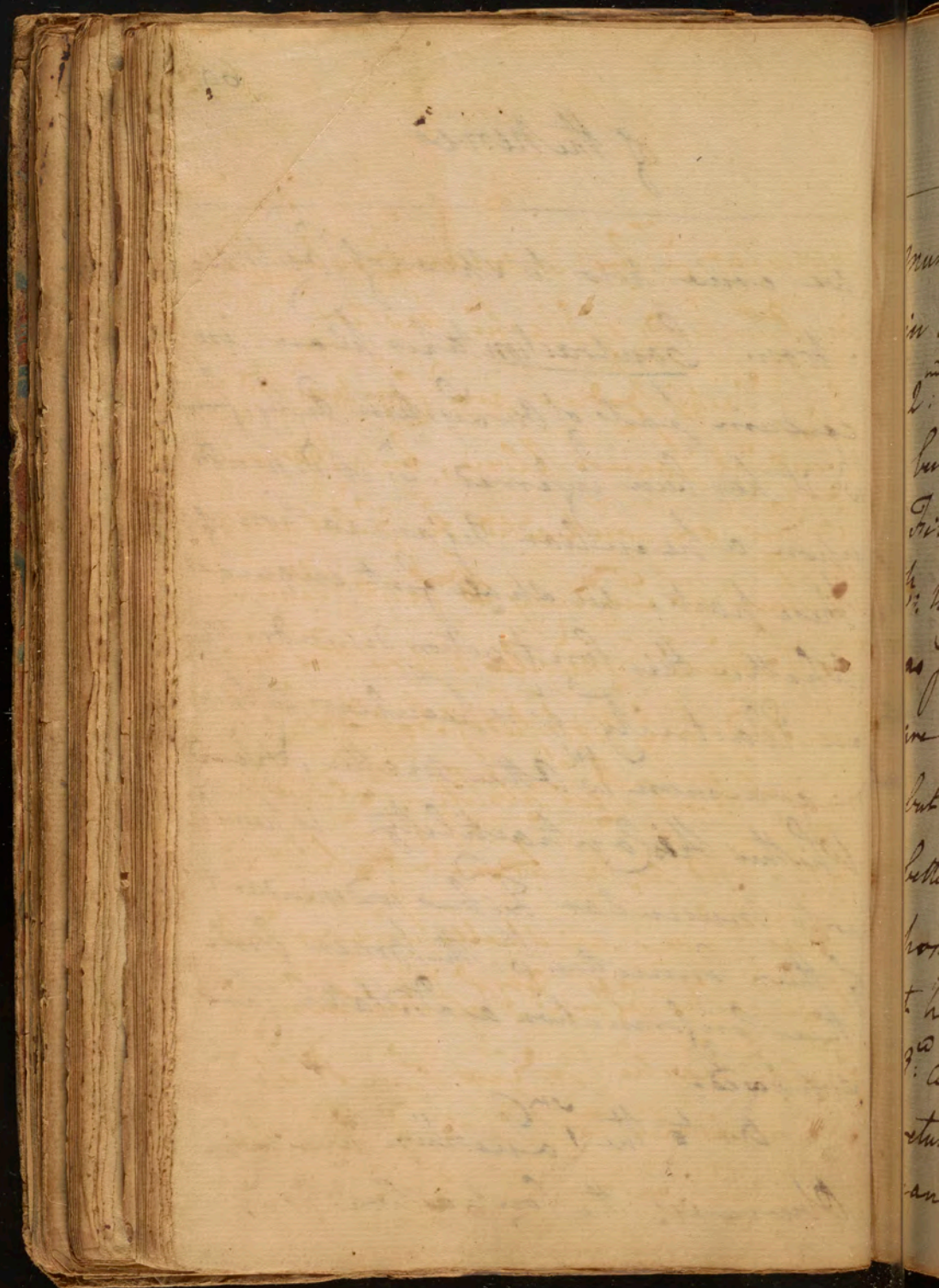
5.th There are Motions w.^h arise not from simple Impressions but are deduced from Reasons & are excited as means to an End. the former motions are all Involuntary or Instinctive this last Rational & Voluntary.



of the nerves

we come now to speak of Contraction. Contraction takes place in certain parts of our System Only. from ^{wh} it has been inferred th it depends upon a peculiar Organization of these parts. we shall first enquire whether this Contraction depends upon an Elasticity th is peculiar to them in common wth other matter, & secondly whether this Contractility is peculiar to Muscular Fibres independant of their Connection wth the Brain from their Conformation as Dr. Haller has supposed.

As to the ^{1st} Question we may observe th the Contraction in



Muscular Fibres is much greater than in other kinds of Elastic matter.

2.nd Elastic Bodies are Contracted by bending power Alone, but Muscular Fibres are contracted by Substances th have no Tendency to bend them such as Stimuli. Muscles upon this Acc^t are said to be possessed of Irritability.

but I think Irritability would be a better word as the term Irritability sup-
-poses force. we shall however call it hereafter after Dr Whist Irritability.

3.rd All Elastic Bodies when stretched return again to their Orig^l Length, nor can any thing make them contract when

as Elastic Matters are capable of
Contraction only when in a state of
Tension, but this is not ^{the} Case in
Animal Fibres, for they contract
when relaxed, or even when cut out
of the Body.

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of the Nerves

Let us now enquire to w^h parts of the System this Contraction belongs.

— we know it belongs to all Muscles; but how shall we tell w^h parts of the Body are muscular & w^h are not?

— Some Physiologists confine it to all parts that are possessed of Irritability which I know of nothing to contradict.

on w^h Organisation does $\frac{1}{2}$ Contraction of Muscular Fibres depend? — this is a most difficult question. But before we discuss this we shall enquire whether this Contraction is peculiar to Muscular Fibres themselves, or whether it depends on the Brain? — all Physiologists

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of the nerves.

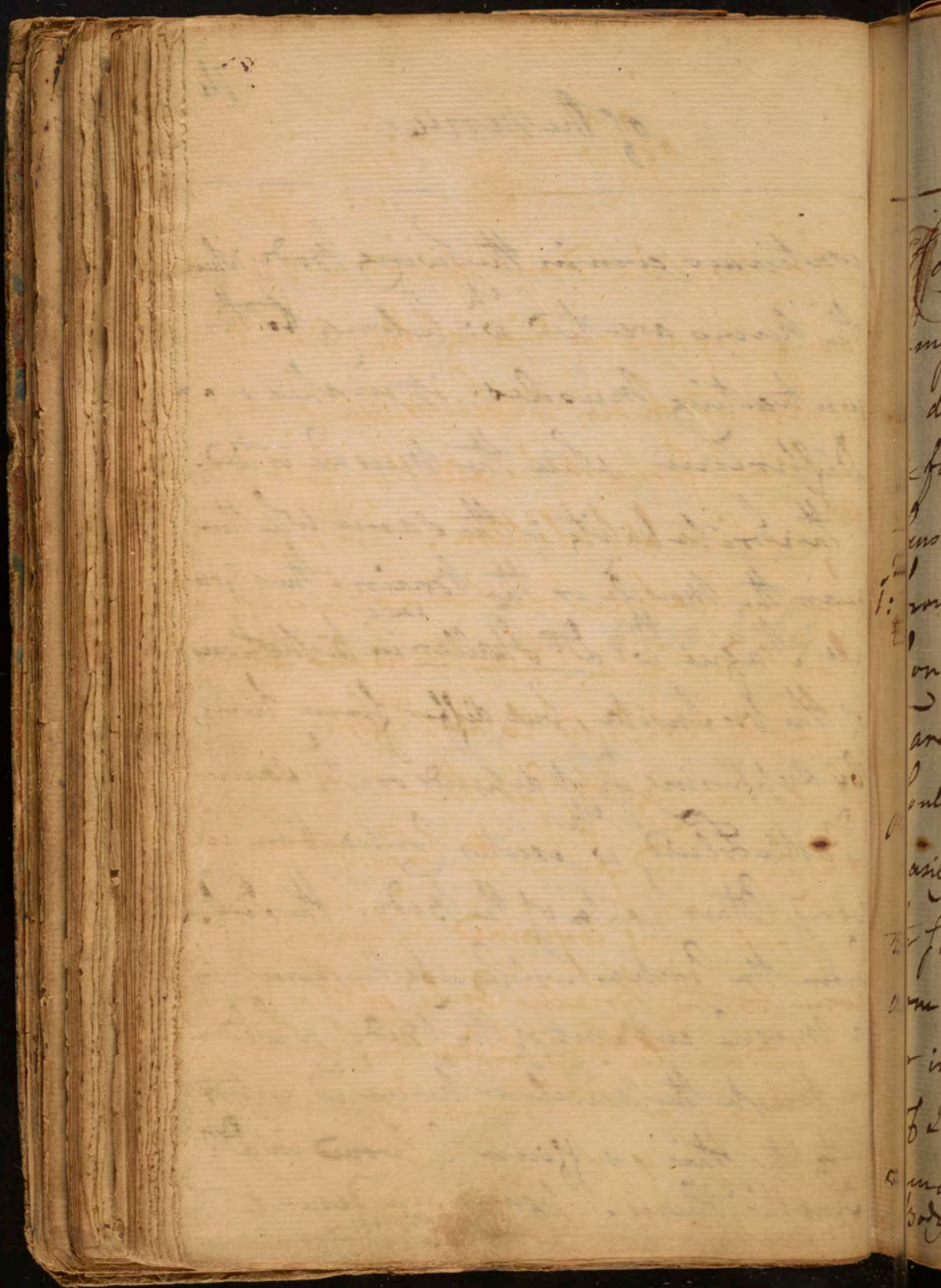
suppose some accessory power such
as an Influx of Blood or nervous Other
to be necessary to Contraction except Dr.
Haller & a few Others. we grant that
a ~~man~~ Muscle cut out of the Body is
a nerve fixed to it will contract.
But this continues but a very short time.
on w: does it depend? on the Mechanism
of the Muscle? or on a sentient prin-
ciple? the last is improbable.
we must then admit Dr. Haller's
vis Insita & say there may be Contrac-
tion th wth out any Influx or accessory
power. we find Contraction

(a) *De Primo Lince* 5403. & 404

of the nerves

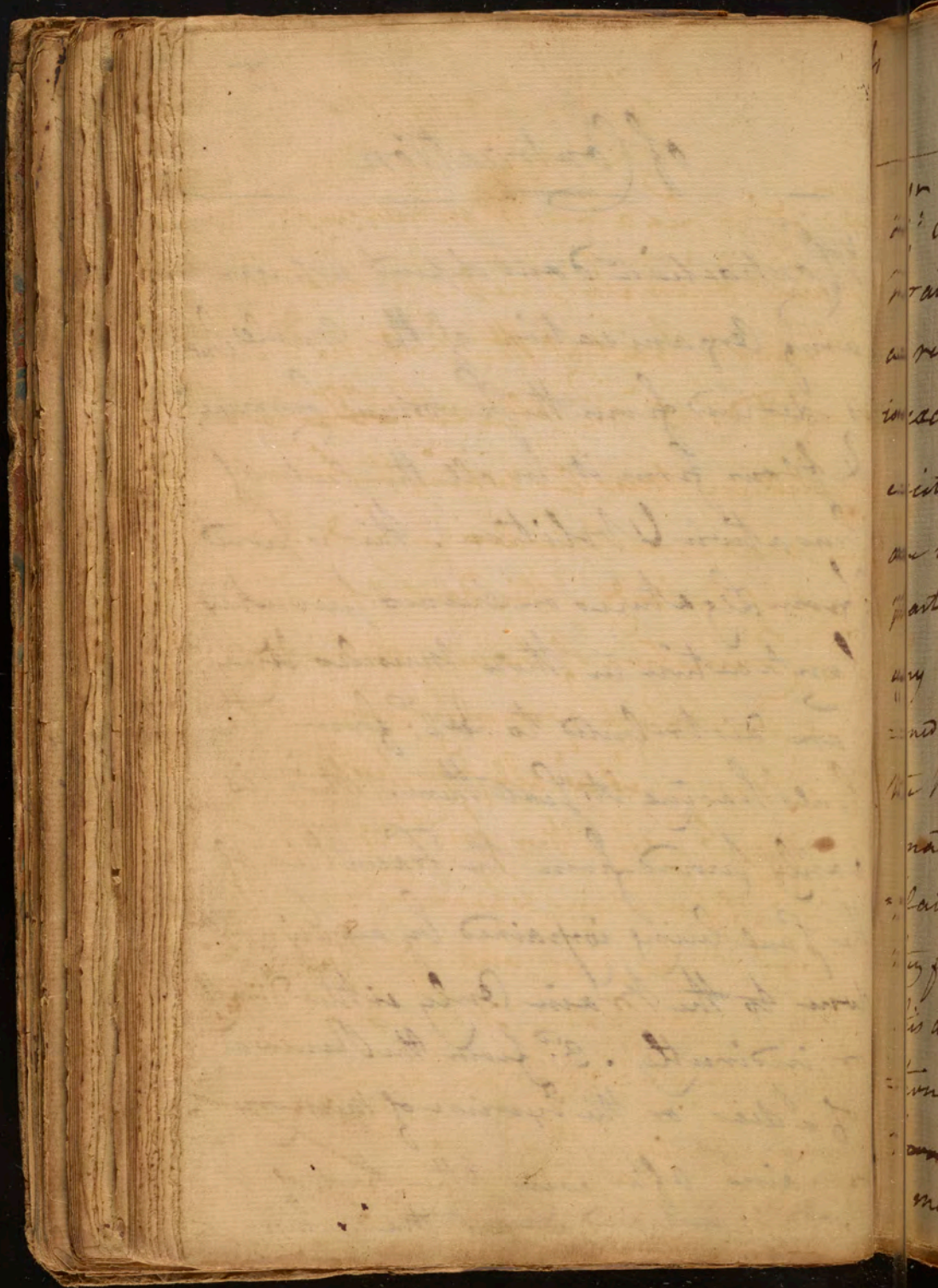
74

continues even in the living body when
the nerves are tied w: ^{ch} belong to the
contracting muscles. it makes no
Difference when the muscle is tied.
The Irritability is the same whether
near the muscle or the brain. Thus you
see I agree w: th D^r Haller in his notions
of the vis Insita, but differ from him,
by supposing y: it depends on ^{the} same
Elastic Fluid w: ^{ch} excites contraction in
every other part of the body. This is in
fact the contraction being the same in
a muscle cut out of the body whether
we touch the muscle or nerve w: ^{ch} enter
into it. This is sufficiently proved in D^r
Smith's Thesis. *pericula hinc desunt
Causa Agitationis.*



of Contraction

Contraction don't depend upon any Organisation of the Muscle, but is derived from the Nervium Commune, & flows from it in all the Acts of Sensation Volition. This is proved 1.^o from Ligatures on nerves preventing Contraction in those Muscles they are distributed to. 2.^o from the Soul's having its Seat there. This is easily proved from the Faculties of the Soul being impaired by an Injury done to the Brain Only either directly or indirectly. 3.^o from the Renewal of Ideas or the Exercise of Memory ^{ca} remains after every other part of the Body is impaired except the Brain.



of Contraction.

4th If a Ligature is made near the Brain & an Impression made on a remote part of the body no Sensation is excited. 5th we often see ^{Repetitions} ~~contractions~~ excited in Muscles when the Impressions are made on Muscles in a different part of the body. This does not depend on any Connection of nerves, but is occasioned by Motion communicated from the Brain. 6th All Sympathies are made. 6th We often find Persons complain of Sensations when the Limb in w^{ch} they feel it has been long cut off. w^h can this depend on? Sure it shows y^t Sensation & Contraction are derived from y^e same Brain. But to all these Arguments some Object & say that there

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Contractions

There are animals who live & exercise
 sensation & contraction who have no
 brains or very imbricated ones. To this
 I would answer that this argument is
 founded on false facts. many experiments
 have shown no brains in Molluscs:
 & in wth Dr Haller has denied its pres-
 ence. But independent of this, we
 must not confine our notions of brain
 too much. it may be extended all thro
 the Medulla Spinalis, & different parts
 of it may be of more or less consequence
 in different animals. Sensation & vol-
 untary motion are not only confined to a brain
 but the Understanding also. This is evident
 1st from the brain's being the origin of all the
 nerves, 2nd from it of the senses being

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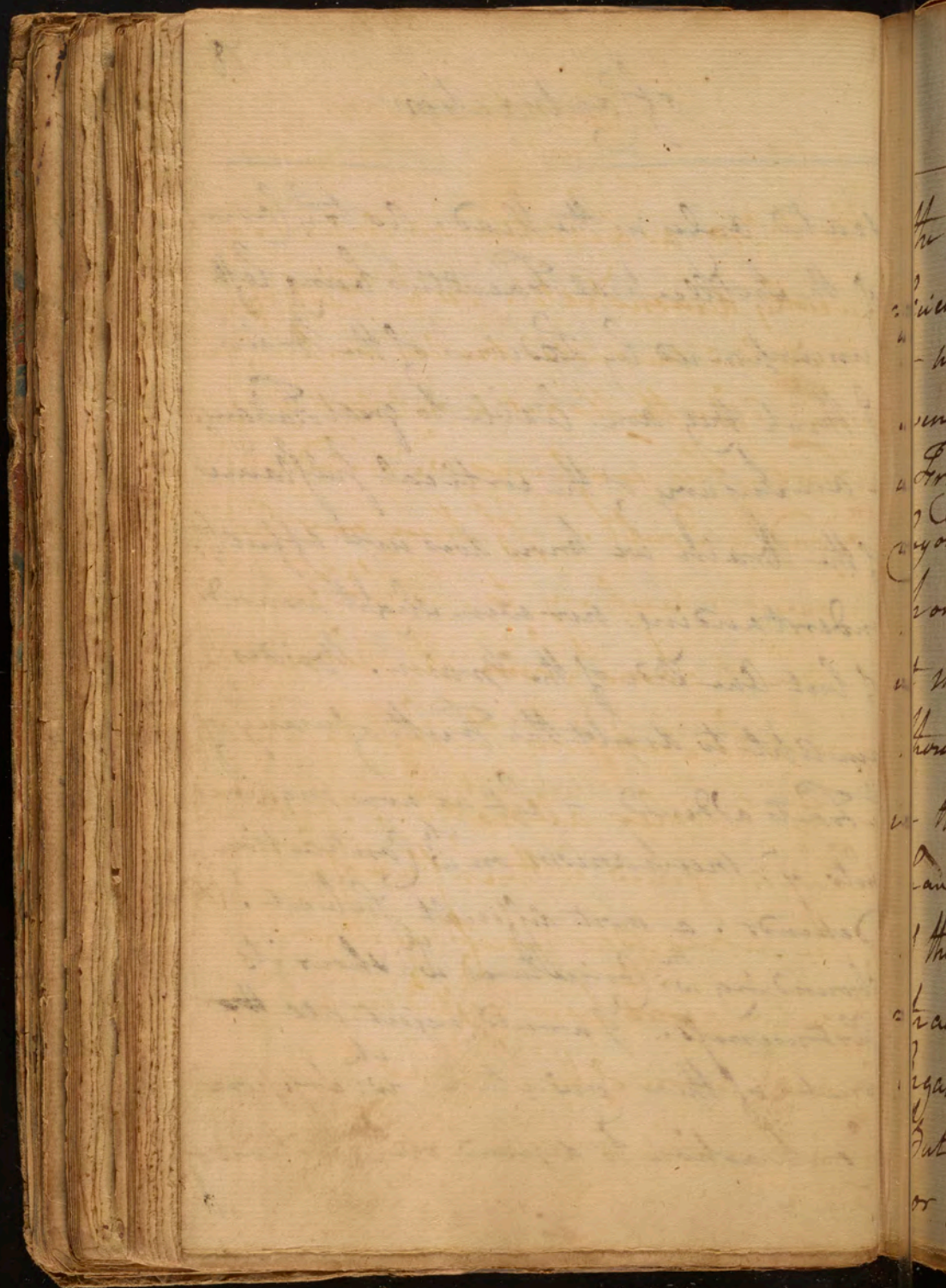
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of Contraction

78

seated only in the Head. As to ^e Cases
of the Intellectual Faculties being left
unimpaired by Lesions of the Brain,
I think they are liable to great Fallacy.
— an Injury of the cortical substance
of the Brain we know does not affect
Understanding, nor even slight wounds
of but one Side of the Brain. Besides I
am apt to doubt the Truth of many of
the Facts adduced. — let us now enquire
into y^e mechanism on ^{ch} which Contraction
depends. a most difficult Subject! &
abounding wth Conjectures w^{ch} show its
Obscurity. I would reject all ~~the~~
such of these Conjectures w^{ch} suppose
Contraction to depend on y^e Motion of



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Contraction

I think it rather depends upon $\frac{1}{2}$ Other
 of our nerves being propelled into the
 muscles, & overcoming $\frac{1}{2}$ Resistance
 of $\frac{1}{2}$ Other ^{ch} w: always comes not only
 our muscles but all other Elastic Bodies.
 - a Doctrine first delivered by Sir
 Isaac Newton: who explains Elasticity
 by it, & gives us exact Calculations of
 the Rarity & Elasticity of these several
 Others. The spiral form of $\frac{1}{2}$ nerves w:
 Dr Smith has lately demonstrated seems
 to favour this supposition.

But ~~why~~ how are Muscles ex-
 cited to Contraction when cut out of
 the Body? to this we answer $\frac{1}{2}$ the
 Other of our nerves is in a very Elastic

(c) to this we may add y : all muscles
have an Alternate Contraction and
Relaxation th w: may arise from ^{the} Tension
of the Ether to restore itself to an Equilib:
= Orium : from this we An^r: for y vital
& Involuntary Motions.

mobile state, & when put in motion
by a stimulus applied to $\frac{1}{4}$ muscular
Fibres reacts again & thus excites mo-
tion. Besides the other of the Fibres may
have such Oscillations by stimuli as
to produce this motion. Here we must
say a few things on stimuli. all stimuli
are Chemical or mechanical. the Action
of the first depends on the Difference of
Oscillations in the Objects w. excite Taste
or Action, for all Bodies have an other
peculiar to themselves w. has Oscillations
according to the different nature of its Parts.
But how do Mech. stimuli act in
those Cases where there is no Impulse?
- why as Repellents only. Such stimuli
must have sharp points & therefore
act by removing the nervous Fibres

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Contraction

from One Another. or by the Ether they contain going out from them into our Nerves at a point & thus gives us pain.

- But how do sedatives act? This is a difficult Question. I formerly supposed all sedatives mixed wth the nervous fluid & thus destroyed its mobility. we have several Chemical Analogies w^{ch} confirm this. but I see many Objections to th^{is}, & therefore am willing to desert it. I think a better Explanation may be given. we just now presumed that sharp pointed stings, &c. added to the Ether of our Nerves. now may we not presume likewise certain substances such as Sedative Medicines have a power of Abstracting this Ether? - we have a strong Analogy to confirm

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Contraction

82

this in the Communication of the Electric
matter to non-Electrics.

Let us now enquire into the dif-
ferent ² states of Muscular Fibres.

1st on w^{ch} does Spasm depend? why
on two Causes. 1st on too great an Affection
of the vis Nervosa, but why it sh^d remain
so I cannot say. 2nd on the stretching
powers being taken off from muscles
lying too long in one position. I shall
hereafter speak more fully on this subject.

- On w^{ch} does Convulsion depend? This
has been confounded wth Spasm by Dr.
Gambros & Others, but I think them
essentially different & depend on different
Causes. If Muscles act wth unusual
Force or velocity we say they are convulsed.
- if they remain long in a contracted

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Contraction

situation we say they are affected
 wth spasm. a want of Tension is the
 great Predisposition to Convulsion.

- This Tension is called Tone or tonic
 power, & depend upon an equal Dis-
 tribution of the nervous Fluid. If this
 by any Accident does not pass in upon
 any part of the Body an Atonia is in-
 duced. This Atonia differs from Paralysis
 not depending upon ^{an} Interruption but on
 want of compression of the vis nervosa.

Before we discuss the Laws of the nervous
 System we shall give a short

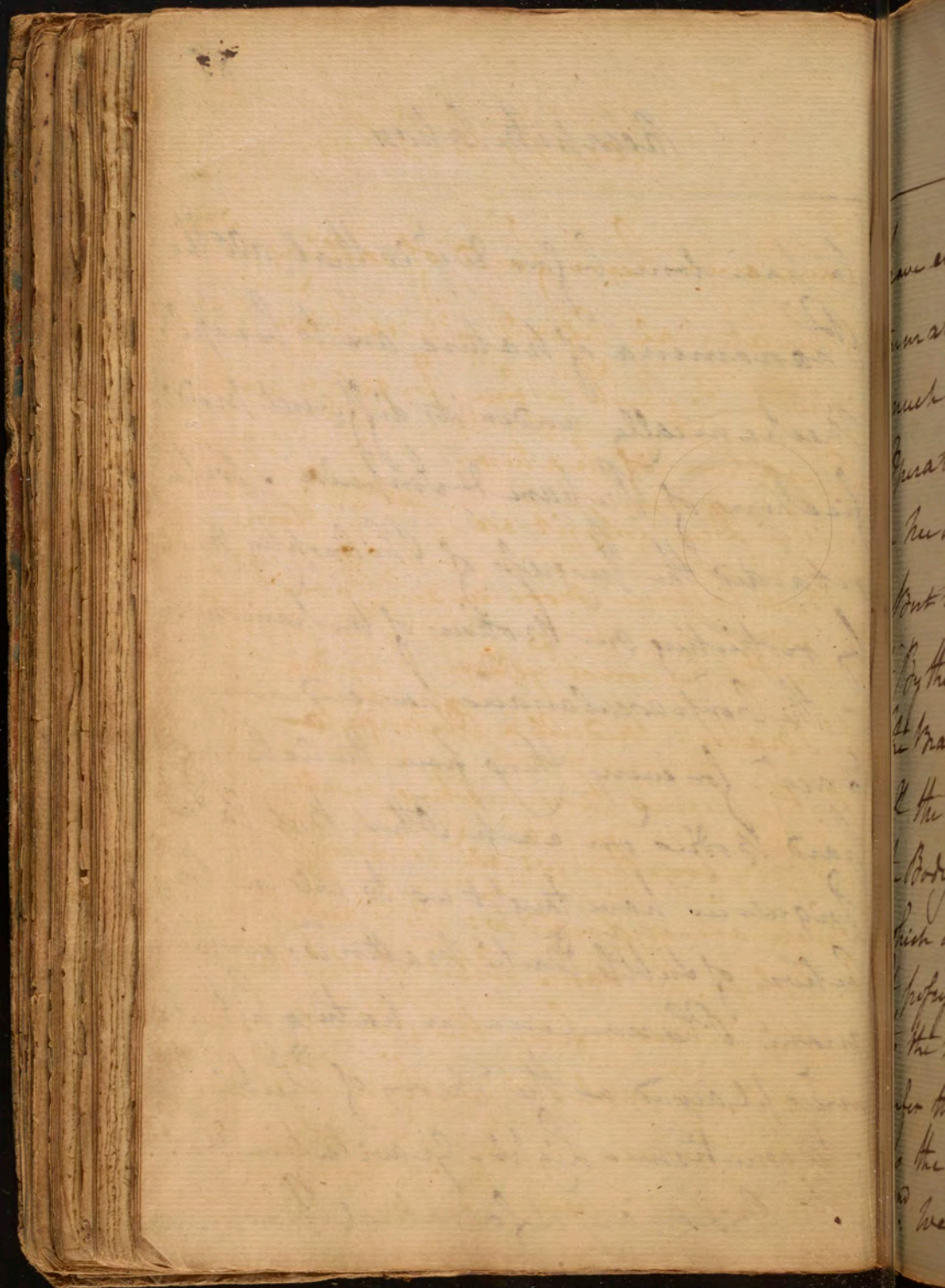
Recapitulation

Here I would premise w^h I ought

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Recapitulation

to have done before & y^e is that all the
 Phenomena of Nature are to be expl^d:
 Mechanically under its different Modi-
 fications of Pressure & Impulse. We have
 retarded the progress of Philosophy much
 by restricting our notions of Mechanism.
 - the Corpuscularians have endeavoured
 to acc^t: for every thing from the action of
 hard Bodies on each Other, but later
 Inquiries have taught us to call in the
 action of subtle Elastic Matter w^{ch} explains
 many Phenomena in Nature hitherto
 unexpl^d; as the Theory of Electricity
 - Magnetism - Light - Gravitation &c.
 - Visionary & fanatical Philosophers



Recapitulation.

have ever been fond of calling in-
 immaterial Agents which have tended
 much to check a free Inquiry into the
 Operations of Nature.

"Res Deus intersit &c

Hor.

But to come more nearly to our Subject.
 By the nervous System I understand
 the Brain - medulla Oblongata & Spinalis
 & the nerves terminating in all parts of
 the Body together w: all muscular Fibres
 which are endowed w: the same sensibility
 & possess the same Ether that is peculiar
 to the nerves. From this I think we may
 infer the muscles have the same structure
 as the nerves.

2nd We said every part of the nervous

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Recapitulation

System was connected which we infer
from Motions being communicated
so uniformly all over the Body by Impressions
made on one part only.

3rd All ^{actions} ~~motions~~ are carried on by motions
excited in the Other y^e adheres to our
Nervous Substance. This I infer from
all our Impressions depending on Oscillations
excited ~~in the Body~~ ^{by the Body's impressions}. Now these Oscillations
can only be bro't on by the motion of
some subtle Fluid in our nerves, for
Oscillations can only act by exciting Oscil-
lations. This Other is not only present in
our nerves, but is always in an excited
State, somewhat analagous to y^e State
of Electricity when the Electric matter is
accumulated in them - to this Analogy we

as this state of excitability in our
nerves is kept up by heat as
we shall show more fully hereafter.

Recapitulation

must add th it is not only in an ex-
cited but Elastic state. ^{see}

1st The nervous System is distinguished into
4 parts, w^{ch} have each of them different
Functions. The 1st Difference consists in
its Fabric in being arranged in distinct
Fibres sometimes however arranged
& mixed wth each Other. This therefore in-
cludes the medullary part of the nervous
System. 2nd Under this Second Head
I would include the nerves w^{ch} consist
of the same matter as ^{the} medullary part,
& ^{are} disposed in Fibres. 3rd includes
the nerves denuded of a membrane
w^{ch} they have in the 2nd state mentioned.
- in this situation they are exposed
to be acted on by the Impulse of external

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Recapitulation

Bodies. the nerves here then are said to be Organs of Sense. ^{ch} includes ^{ch} part of the nervous ~~system~~ ^{ch} Fibres ^{ch} are innervated of the membrane ^{ch} is common to them, & so attached as to be capable of Extension & Contraction. — these we may call the moving ^{ch} extremities of the nerves, in Opposition to the former ^{ch} w: are sensitive ^{ch} extremities

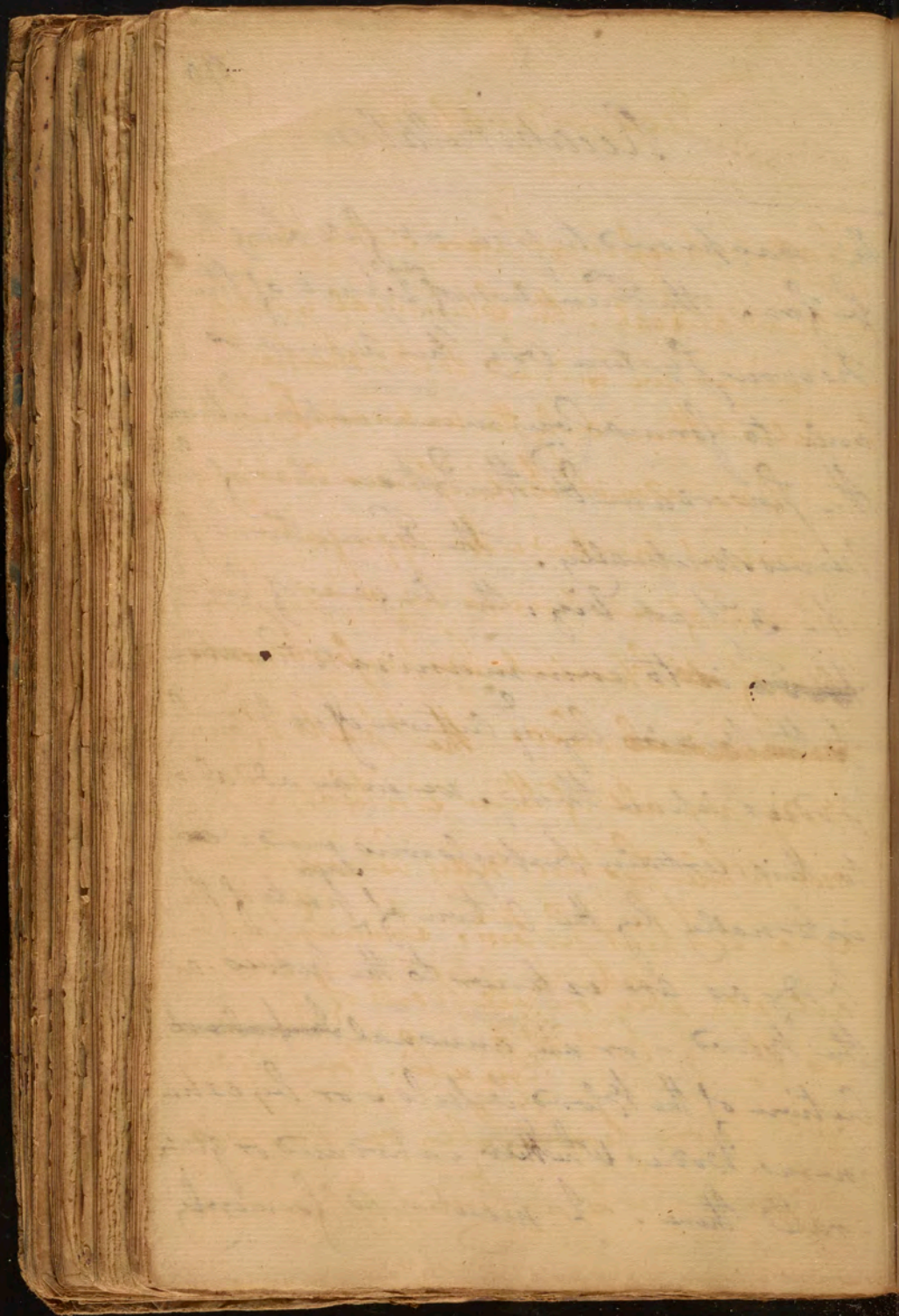
Let us now enquire into their different Functions. to the first then viz: the medullary part belongs ^{Exercise} Thought or the actions of an im: material principle w: is connected ^{ch} w: the action ~~of the~~ or motion of ^{ch} medullary substance Only. the functions in the Brain alone & nowhere else.

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Recapitulation

This was proved to you at full length
 before. the Function of ^{the 2^d} part of the
 nervous system viz the nerves is
 only to form a Communication between
 the sensorium & the Extremities of ^{the} 2^d
 Nerves mutually. The Function of
 the 3^d part viz: the Organs of sense
~~the 3^d~~ is to communicate sensation
 to the brain by ^{the} 2^d action of external
 Bodies upon them. we may add also
 to this certain Impressions made ~~to~~
 internally by the Action of ^{such} parts of the
 Body as are exterior to the Nerves. as
 the blood - or an unusual ~~Impression~~
 Action of the blood vessels - or by extra-
 neous Bodies whether introduced or gene-
 rated there. I mentioned formerly



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Recapitulation

91

That Impressions were either Chemical or mechanical. the Chemical you may remember we reduced to the mechanical. Is called them only the unknown Mechanical?

- If we admit Impressions altering the state of mixture or Aggregation in the Fluid of our nerves we may then talk of ~~the~~ Chemical Impressions ~~being~~ ~~mechanical~~ also. the parts of our Body are all of them sentient, so y^r. our whole System may be considered as a sentient System. Some Impressions act equally on all parts of y^r Body as the Mech^l stimuli. Some again act more powerfully on Muscular Fibres such as Compression - &

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Recapitulation

Heat & Cold. But there are some ^{Gen} sensations w: can be excited only from Impressions made on particular parts. This is difficult to be explained. - it may depend on the greater or less denomination - Impression & extension of the sentient nerves which occasion their giving different sensations. further there are nerves connected w: a certain apparatus in their termination w: qualifies them to admit the impulse of certain bodies only, as the eye Light - the Ear sound & the like. It is by Impression that Life is first excited ~~can~~ & I hope I shall prove that

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Recapitulation ⁹³

It is by Impression only that Life is maintained.

The Function of the 1st part of the System viz: the muscular Fibres is to serve as Organs of sense & Motion. as Organs of motion they are ^{1st} Devoid of a covering they had in the nerves. 2nd they are from their spiral Form & their Attachment to other capable of Extension & Contraction in common w: all simple Nerves. 3rd they are all in common w: ^{the 2nd} solid in a state of Tension. 4th they are in a state of united Elasticity &

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Recapitulation

thus differ from simple Vasties, &
Abound w: an th other on the Abstraction
or Addition of th w: the Action of th Solutions
& Stimulants depend.

Having finished $\frac{1}{4}$ Recapitulation
I shall now proceed to speak of the
general Laws of the nervous system.
1st I shall speak of Sensibility
& Irritability.

all Bodies w: act upon ^{us} ~~an~~ produce
sensations, this Capacity of having
sensations, ^{excited} is called sensibility.

- Those Bodies w: th excite motion
are said to produce Irritation, and
the parts capable of this are said to





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Laws of the nervous system

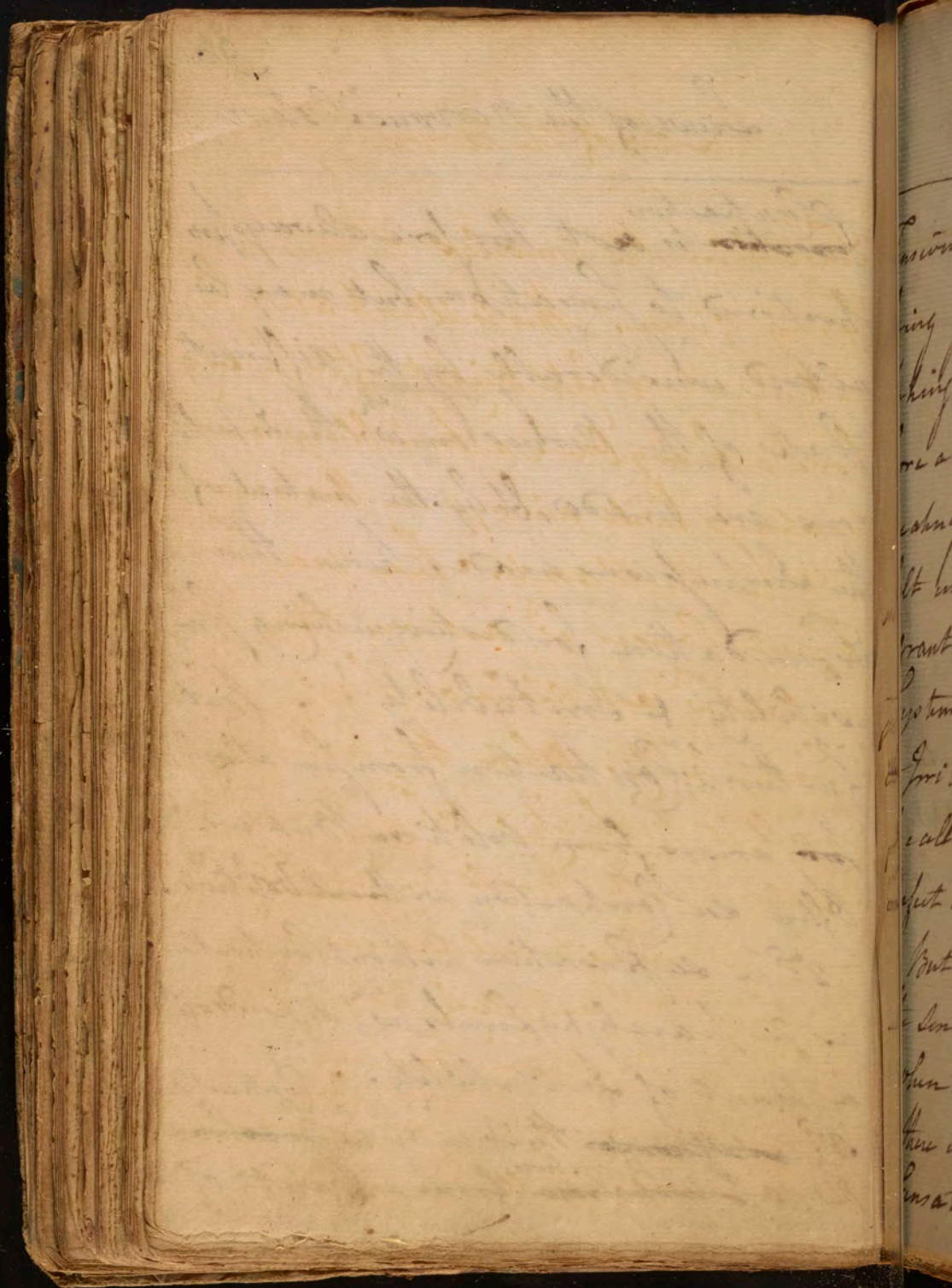
be possessed of Irritability. There can be no Contraction without Sensation, & it is ~~always~~ in many Cases ~~is~~ exactly proportioned to this Sensation. See D. Gaubius §190 where he says Irritability is always proportioned to Sensibility. See also §174

But this is by no means universally true. Altho it is difficult to point out where they are to be distinguished.

— The same Causes do generally produce the same Effects, but this sh^d be used wth some Limitation. Causes are not always simple, but often compound, & the Effects will always be according to the Nature of the Causes.

Laws of the nervous System

~~Contraction~~
~~Contraction~~ is not therefore always pro-
 -portioned to sensation, but may be
 altered considerably by the different
 states of the Nerves on w^{ch} the Impres-
 sions are made, & by the nature of
 the Impressions made. Hence then a
 Foundation for distinguishing Sen-
 sibility & Irritability! But
 further: 1st Contraction from sensation
 too arises from volition. But we
 often see Contraction without volition.
 2nd we see sensation without Contraction
 as in paralytic Limbs w^{ch} depend on
 a want of Irritability. Contraction
 3rd ~~we observe~~ there may be ^{sensation} ~~contraction~~
 & no ~~contraction~~ from a want of



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Laws of the nervous system

Tension in the muscles the vis nervea being given. This is illustrated by taking up a light weight after having bore a heavy one. a trembling and weakness will always in this case be felt in the hand. There may be 2^d grant Causes w^h act on the whole system w^h act alike on sensibility & irritability. When this is the case I call it mobility. When there is a defect in both I call it Inertia.

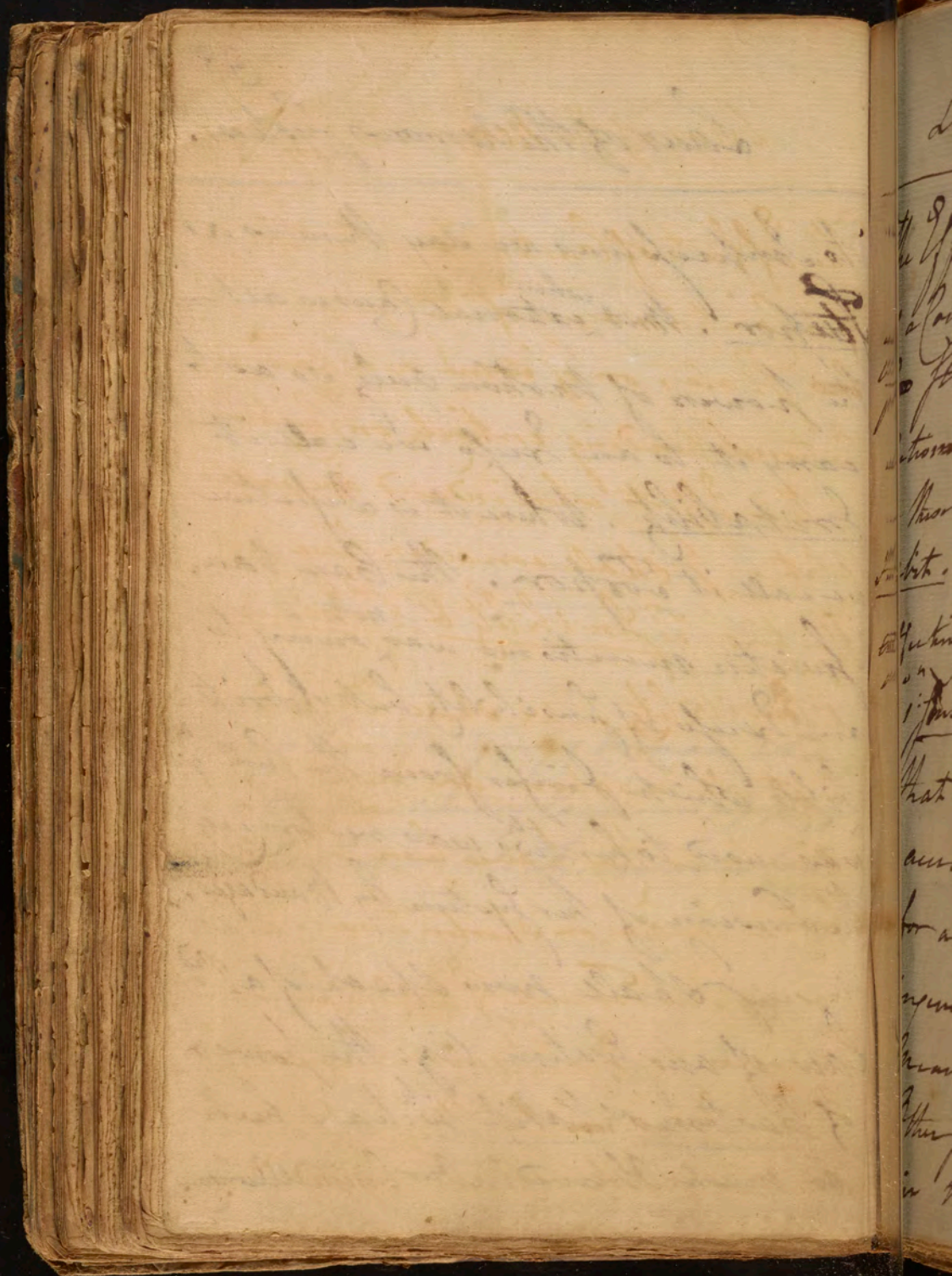
- But when external Causes act on the sentient parts only we say here when the parts are too sentient, i^e there is an excess of sensibility. When sensations are dull & not proportioned

as a Case of a young woman whose
System from sundry Causes was hurried
in deep of Irritability. Banawick Com:
See

Law of the Nervous System.

to Impressions we say there is a
Torpor. But ^{when} external Causes act on
 the powers of Motion only so as to
 carry it to an Excess we call it
Irritability. When it is defective
 we call it Torpor. The Case Van.
 Swieten mentions was ^{not} owing to
 an Excess of Sensibility but of Irrita-
 bility which I infer from the Cure ^h
 was used to her w^{ch} was restoring
 the Function of her system by Bandages.

I shall now speak of a 2nd
 Law of our system viz: the power
 of Custom & Habit w^{ch} have been
 so much Observed in our Animal Economy.



99

Laws of the Nervous System.

The Effects of Custom are the Effects of a Continuance of the System in one ~~for~~ State, or of some new Law on Actions depending entirely on Custom.

— These Effects when induced are called Habits. I shall consider these as affecting 1: Sensibility & 2: Irritability

1: Sensibility. we shall remark 1: That all Sensations are more or less acute as they have been continued. for a longer or shorter time. a late ingenious French Gentleman found Means to distinguish Gems from other stones and by their shining in the dark which he did by

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Laws of the Nervous System

confining himself for some hours
in the Dark before he viewed them.

— from hence we learn th our sensa-
tions are no measure of the state
of things around us. ~~ex~~ ^{spec} this is
exemplified by the sensations of Heat &
Cold differing according to the degree of
Heat in our Bodies. This in my Opinion
furnishes the strongest Argument
reg^d the frigorific as well as the
Calorific particles. The different
sensations of Heat & Cold altho' but
different degrees of the same Quality serve

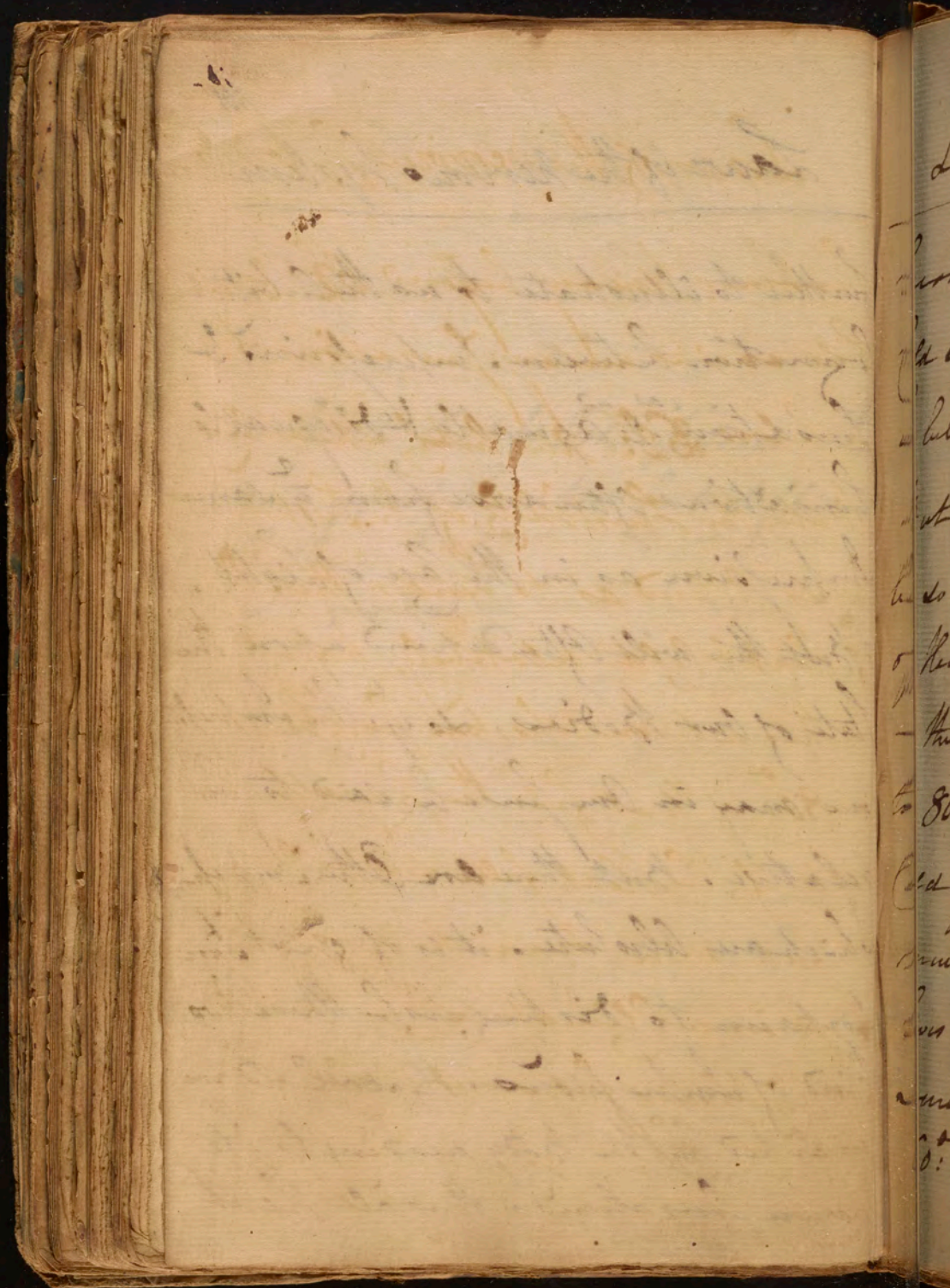
as both Heat & Cold produce the
same direct sensation but different
Reflex.

101

Laws of the nervous System.

Further to illustrate to us the arbitrary
Connection between Impressions &
Sensation. ^{as no} 2. Agreeable & disagreeable
Sensations often arise from ² the same
Impression as in the Case of Light.

But this will often depend upon the
State of our Bodies, so y^t the Impressi-
ons may in one sense be said to be
relative. But there are other Impressions
which are absolute. it is of great Im-
portance to distinguish these two
kind of Impressions. Heat & Cold are
marked by the Body according to its
own sensations. thus all Heat



Law of the nervous System.

becomes uneasy beyond 62° , & all Cold excites uneasy sensations that is below 62° . Absolutely speaking, But the Sensibility of the System may be so altered as to render these Degrees of Heat & Cold relatively painful. - Thus a man who has long been used to 80° of Heat feels the sensation of Cold if the Heat falls suddenly to 70° ; much more than he does who lives in a Climate where the Cold some times falls suddenly from 60° to 50° . - Hence we see the

as viz: in being colder

as by assume a virtue if y^e have it not
as y^e Monster Custom Who all sense doth eat
of Habits will, is Angel yet in this

Refrain tonight
" & that shall lend a kind of easiness
to the next Abstinence, the next more can
for we can almost change y^e stamp of Nature
" & master even the Devil, or throw him
with wondrous potency

Shakespeare's Hamlet

Law of the Nerv. System

Fallacy of Dr. Witheringham's Ob-
 servations on Epidemic Diseases
 who supposes that Hippoc. Doctrines
 will hold good in Britain altho
 its Climate differs so much from y:
 of Greece. 3. Impressions become
 less sensible according to their Repetition.
 - Thus some Impressions w: are at
 first painful after a while become
 pleasant as in the case of Tobacco,
 - Spirituous Liquors - Odours &c.
 This admits of great Application
 in Morals ^{as} as well as Medicine.
 - Brandy becomes necessary if

(ci) This is a wise Law in Nature
& serves to defend us from many
Things y^e would Otherwise injure

104

Laws of the Nervous System

we have been long used to it an
purpose to keep up a Tension in y^e
nerves ~~is~~ a want of which is atten-
-ded wth uneasiness. the longer we
use Brandy the more we require of
it to keep up this Tension. This
leads me to speak of y^e Operation
of Medicines. Vomits & purges loose
their Force by being often repeated & as
4th Sensations arising from Comparisons
are more or less acute as they have
been repeated. Thus a Linnendrawer
-per is able from being so long

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105

Law of the Nerv. System.

used to handle Cloaths to tell the
moment he puts his Finger on a piece
~~to tell~~ ^{at} once its degree of Fineness.

— This Law belongs rather to Experi-
ence than Custom.

5. any two sensations by being ex-
-cited together are ever after connected.
hence arises the Association of
Ideas. This Association 'dont al-
ways depend upon Repetition but
upon the Relation of things also, and
on this last kind of Association depends
the most useful ~~kind~~ species of memory.
— Artificial memory depends on the
first kind of Association.

5

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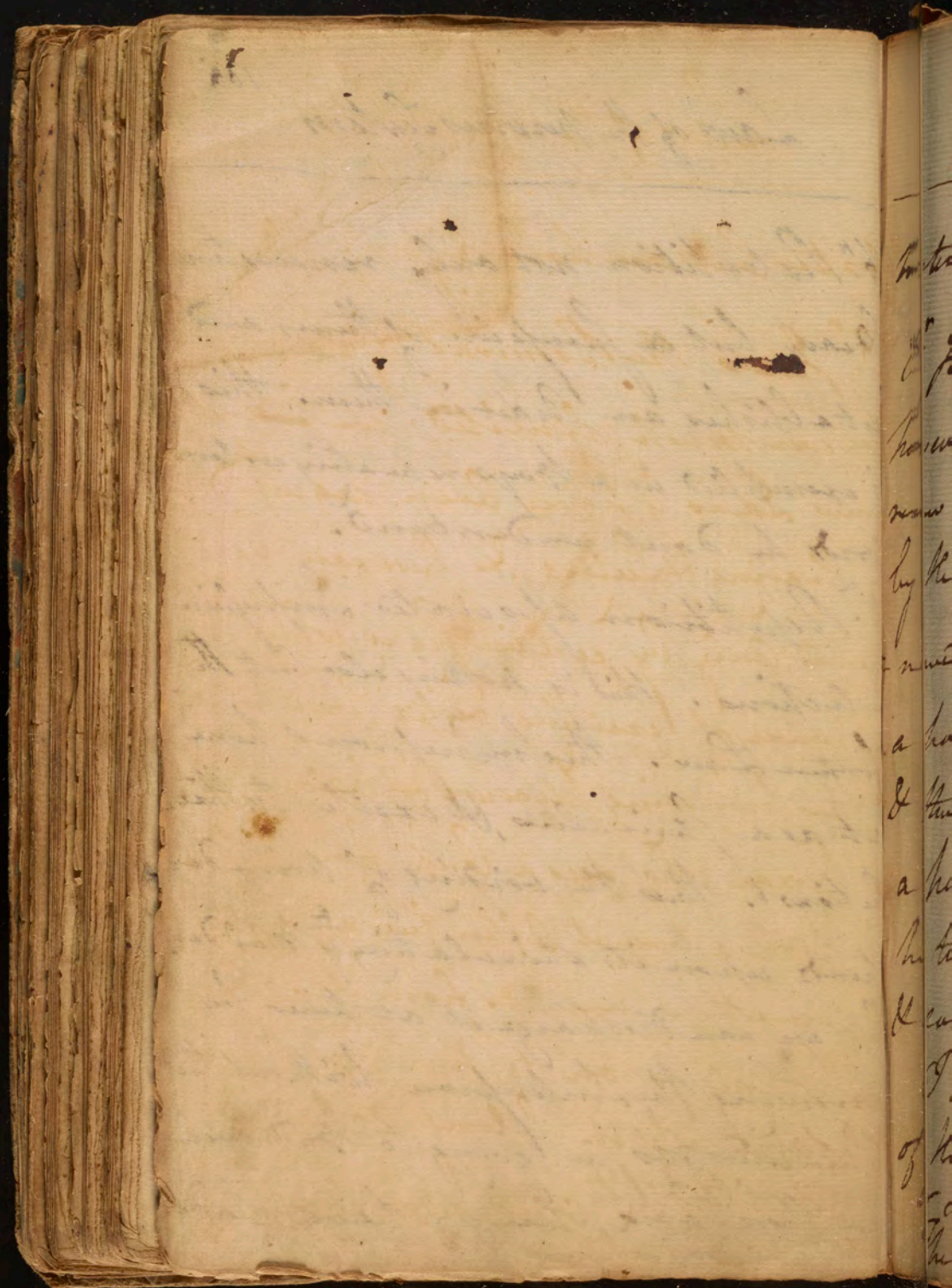
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106

Laws of the nervous System

6th Repetition not only renews two Ideas, but a succession of them, and establishes an Order in them. This is exemplified in a Boy repeating certain words he don't understand.

7th Repetition associates Impressions & Actions. This is nothing else but the former Law. The Impressions here act as a stimulus, & excite to these Actions. Thus the voiding of Urine depends upon its stimulating ^{the} bladder, but we can discharge it at times by renewing the Impression without the stimulus, as in going to bed even in those Cases when we have made



187

Laws of the Nervous System.

water but an hour before.

8.th ~~From~~ the Renewal of Ideas is however much limited. we ~~can~~ only renew Ideas if have been acquired by Hearing & Seeing, & these can be renewed only by certain signs which have a power of exciting reflex sensations & thus producing pleasure or pain. Thus a person who sees a Cup from which he took a vomit After feels a nausea & sometimes vomits from it.

I shall go on to mention the laws of Habit which belong to Action or Irritability.

The 1st is that the Repetition of

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108

Laws of the Nervous System.

Action has great Influence upon the Tension of our Muscles. Thus a man who has long been used to carry a weight is not able to leap to any considerable distance without some Load in his hands.

2nd a Repetition of Actions gives us a greater Facility in them. The most difficult Actions become easy by Repetition: it generally attends those Actions th depend on ^{the} stimulus which arises from an increased Irritability in ^{the} moving parts. This does not contradict ^{the} Law we mentioned under the Head of Facility. - we often see Facility diminished & yet Irritability increased. They do not however observe any regular Laws,

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Law of the new System.

It is hard to tell when they mutually take place.

3^d Actions frequently repeated not only become more easy but Spontaneous & arise without ~~thought or reflection~~
^{or volition} sensations, w. formerly attended them.

Respiration was at first a voluntary action, but in consequence of frequent Exercise becomes involuntary & goes forward in Life. in this Case Irritability increases while Sensibility is diminished.

- But is ^{there} not here an Effect without a Cause? - viz: Irritability ~~without~~ or Action without sensation or volition. No.

- There is always a Cause in these cases, i.e. a stimulus or Impression affecting

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Law of the new System.

the Lungs. When this An? I think we ought to reject the word Spontaneous, from our Theories of the Anim: Economy.

- The Action in Respiration is therefore entirely mechanical. hence no Consciousness ever attends it. I do not suppose this Function was originally mechanical - we know y: sensation & volition are obliterated by Habit, and as this is y: case we cannot tell w: Actions were mech: and w: were voluntary as the Transition generally happens in the state of Infancy. Even the Heart itself may have been originally under the Command of the Will. We certainly exercise a power over it in many Cases as in several

Letter of the Rev. Mr. [illegible]

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Law of the Nerv. System.

of the Pupils particularly in Leger.
 — the Motion of the pupil I believe
 were originally voluntary; sensation
 volition being Obscured or lost by the
 frequent stimulus of Light upon it.

4. Repetition gives Force to Muscu-
 lar Contraction. If Muscles are exercised
 too violently & suddenly it gives Languor
 & Debility, but if gradually exercised wth
 too much violence they become strong.
 you have all kinds of the story of the
 man who by lifting a calf every day
 was at last able to lift it when it grew
 to an Ox. — Exercise serves to apply
^{nutrition} ~~nutrition~~ now the more they are

[illegible]

Law of the Nerv: System

are exercised the more nutrition they derive. frequent Exercise may likewise give a more excited state, or more Density & Elasticity to the Nervous Matter.

5th Repetition regulates & determines the Degree of Muscular Contraction. the

Rope: Dancers & Tumblers acquire their Agility entirely by Habit. the Degree of Velocity in Actions is determined by Habit. the Duration of Contraction is likewise determined by Habit. we can't keep certain Muscles in a contracted state above a certain time. I cannot hold my Breath above 20 of a Minute without feeling pain, but Divers

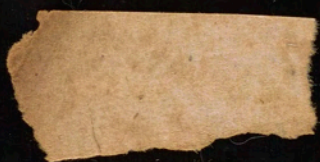
Law of the Nerv. System.

& Frognipers can detain their breath for 2 minutes without feeling the least uneasiness ^{or} is entirely owing to Habit. Lastly the Degree of Tension in Muscles is regulated by Habit.

These Laws apply to internal as well as external Actions.

6.th Repetition associates motions, as for Example. The Motion of the two Eyes. The Actions of the Hands & Feet often become mutually associated merely in consequence of Habit. 'tis wonderful to see how uniformly these Associations take place in human life. - ~~The~~ more than two Impressions & Actions may be associated together, but

Absorbents



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Law of the Nerv: System.

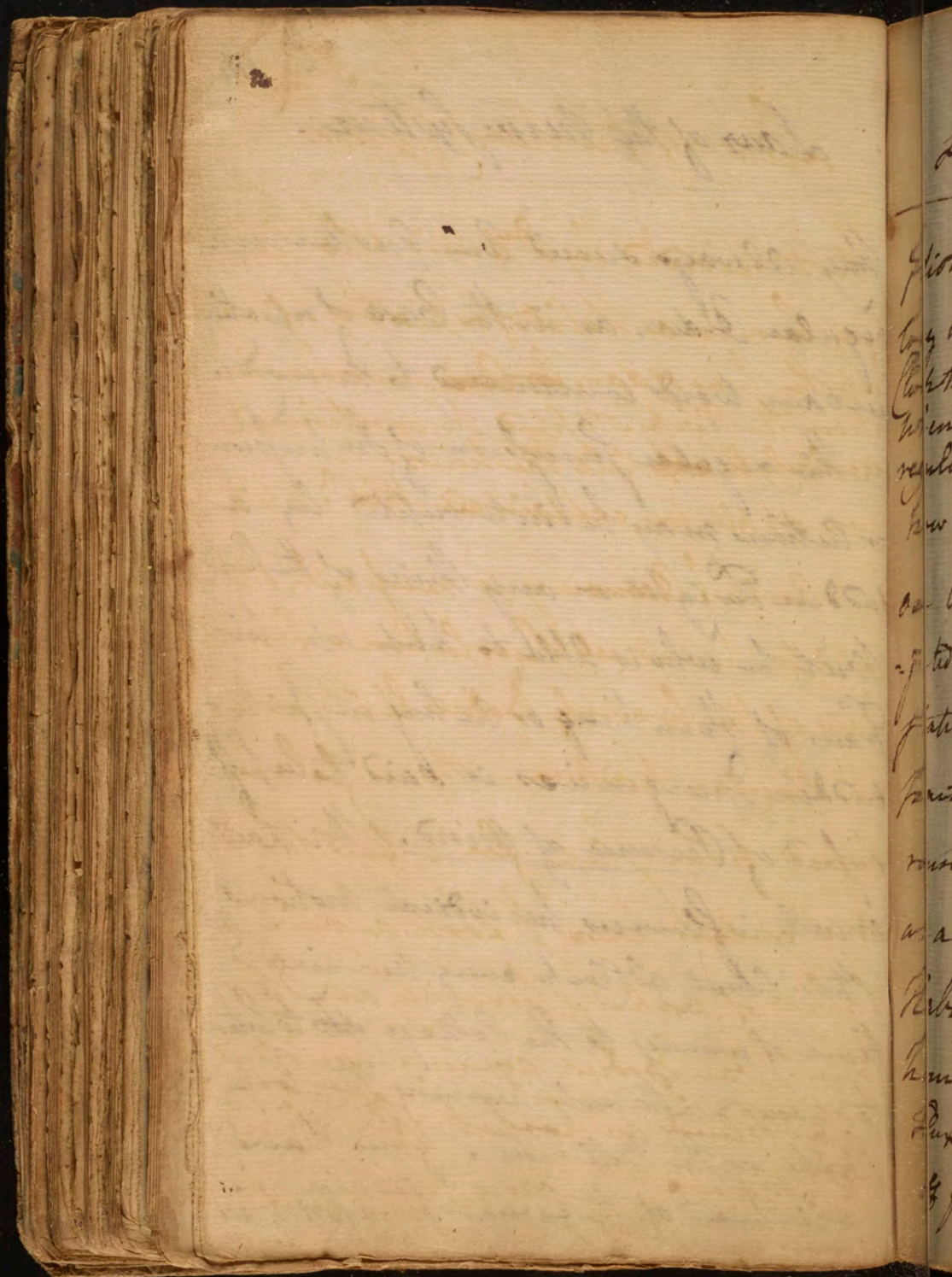
They always succeed one another in a regular Order, as in the Case of repeating certain words committed to Memory.

- This regular succession of Impressions or Actions may be interrupted by a sudden Fright or any thing of the kind,

But he who is able to keep up his Train of Thinking or Acting in spite of sudden Emergencies is said to be possessed of Presence of Mind. This Law

greatly influences periodical Motions.

Thus about 9 o'clock every morning I think of coming to the College ~~to~~ to lecture to you without hearing the Clock strike or the bell ring. You have all heard of the famous Staffordshire

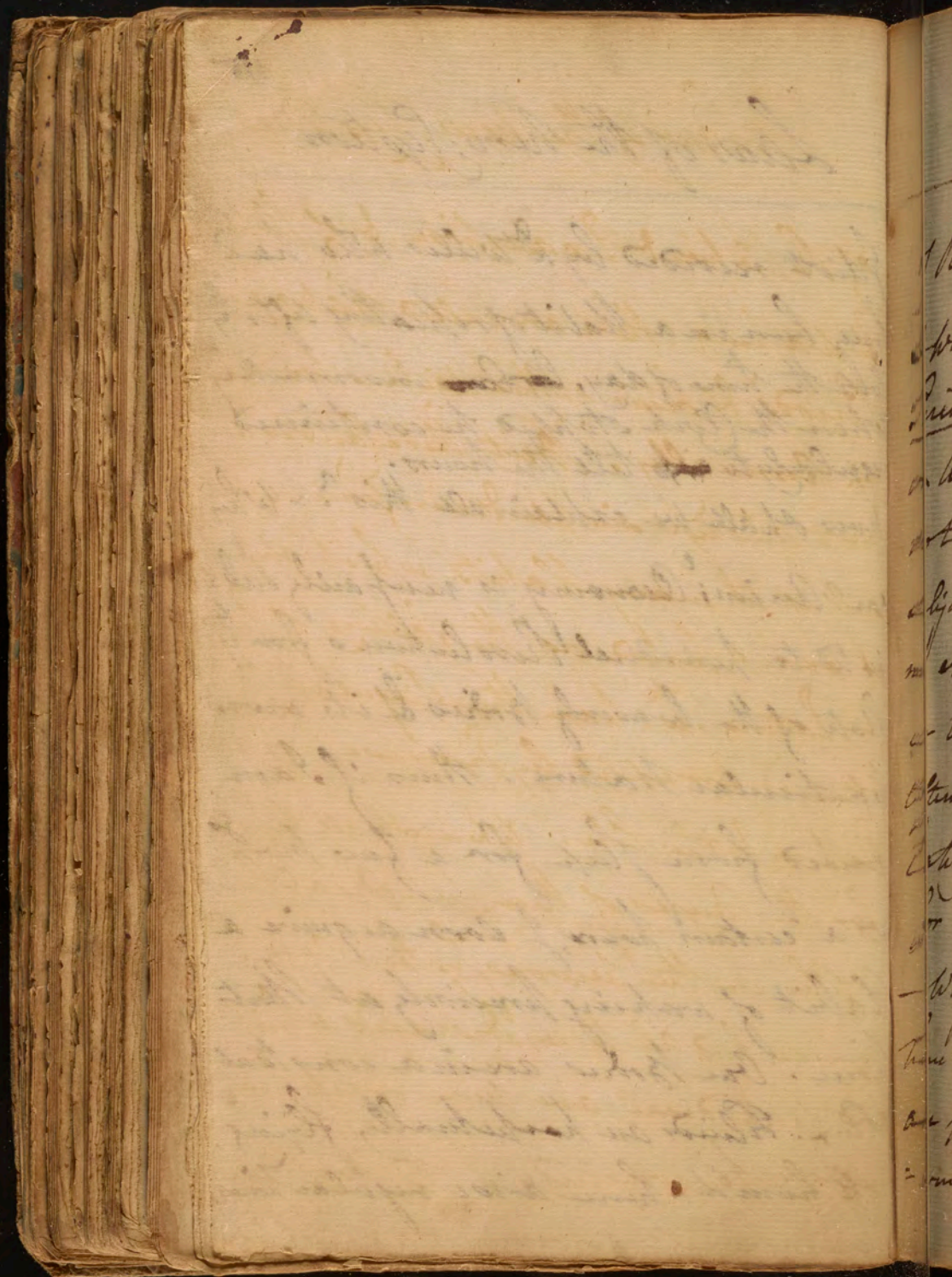


158

Law of the Nerv. System

Idiot recorded by Dr Willis who had
long been in a Habit of repeating after ^{the}
Clock the time of day, ~~at~~ insomuch
when the Clock stopped he continued
regularly to ~~say~~ tell the hours.

Now shall we explain all this? - Why
our Animⁱ Economy is necessarily sub-
jected to periodical Revolution & from ^{the}
state of the heavenly bodies & its own
particular Nature. Thus if I am
roused from sleep for a few morn^{gs}
at a certain hour, I soon acquire a
Habit of waking precisely at that
hour. Our Bodies are in a constant
Flux. Fluids are perpetually flying
off from it, hence arise regular times



Laws of the new System

of Reflection & Caution, & of sleeping
 & waking. these are called Natural
Periods & occur either daily - weekly
 or Annually. But these causes are
 not always simple & uniform. we are
 subject to many habits which obtrude
 no exact period, as the falling of sleep
 or eating, th we have their Regularity
 often interrupted by Exercise - over
 eating & the like. When shall I look
 for the Causes of these periodical habits?
 - Why in the nervous system only.
 Hence we find all those Diseases which
 are periodical are more or less ner-
 -vous. To conclude I add that our

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Laws of the Nerv: System.

System is made of periodical Habits,
 & hence the Reason why Artificial
 Cures are so easily induced.

This finishes the Consideration of the
 Laws of Custom & Habit. it is a sub-
 ject of great Importance in Physic,
 but more especially so in the Preservation
 of Health. hence Celsus so wisely cautions
 us ag^t the power & Influence of all
 Habits, which lays us Open to many
 occasional Causes of Diseases. I know
 a Lady who from being confined for
 a few weeks to a dark Room for an
 inflamed ^{eye} has not been able to bear
 the Light of the sun for some years.

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Law of the new system.

- I might easily illustrate the ill-consequence of Habit over Irritability as well as sensibility. Beluz even goes so far as to recommend Vesicæ at times to guard ag^t the Effects of Habits. But there are some Habits w^{ch} we should endeavour to acquire as those which tend to diminish the sensibility of the System especially w^{ch} regard to Cold, but the Acquisition not only of this but of all other Habits sh^d be gradual. For upon this ac^t could it be possible I never w^d suffer Children to taste animal Food till they were 15 or 16 years old as it acts as a stimulus, &

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119

Laws of the nerv: system

thus tends to wear out the system.
in a word Habits sh^d: be avoided by
healthy Persons, but they become
absolutely necessary in weakly Persons.
it was only by Habit - ^{ie} by living by
weight & measure y^t. Lewis Cornaro
prolonged his Life so long.

I shall now go to mention those
Causes, Circumstances & Conditions
^{ch} w^h: influence the nervous system in
sickness & Health. I shall therefore
^{1st} speak of those Causes Circumstances
& Conditions ^{ch} w^h: influence the System in
general, &
^{2nd} upon those Causes, Circumstances

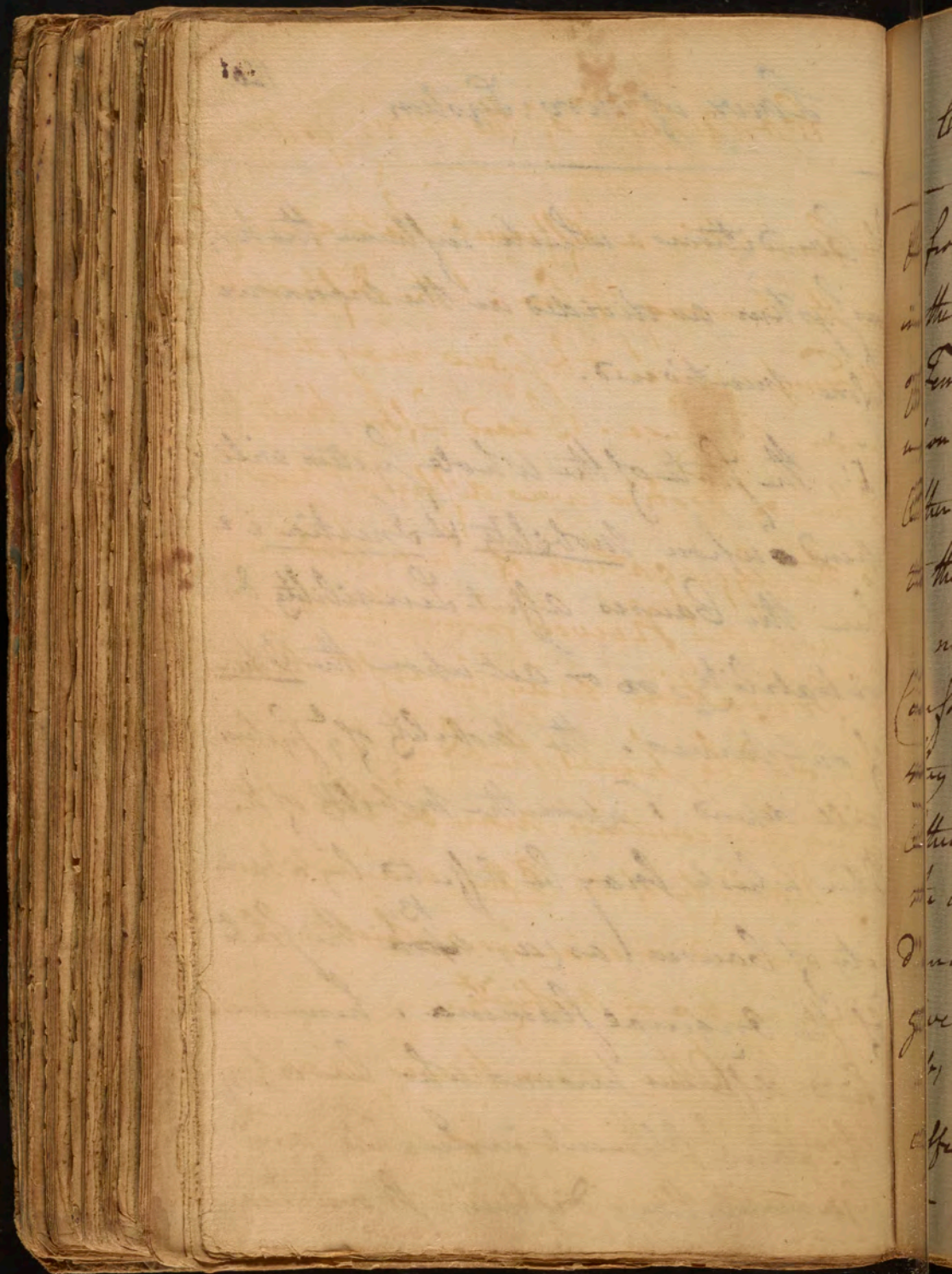
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& Conditions which influence the Nervous System as divided in the manner before mentioned.

I: The state of the whole System will depend upon Mobility & Inertia i.e. where the Causes affect Sensibility & Irritability, or act upon the Other of our nerves. The Mobility of the System will depend upon the Mobility of the Other which may be affected by a variety of Causes (as (a), ^{By} ~~upon~~ the state of the Original Stamina. hence we find different persons who live upon the same Aliment in Equality and Quantity have different Stamina



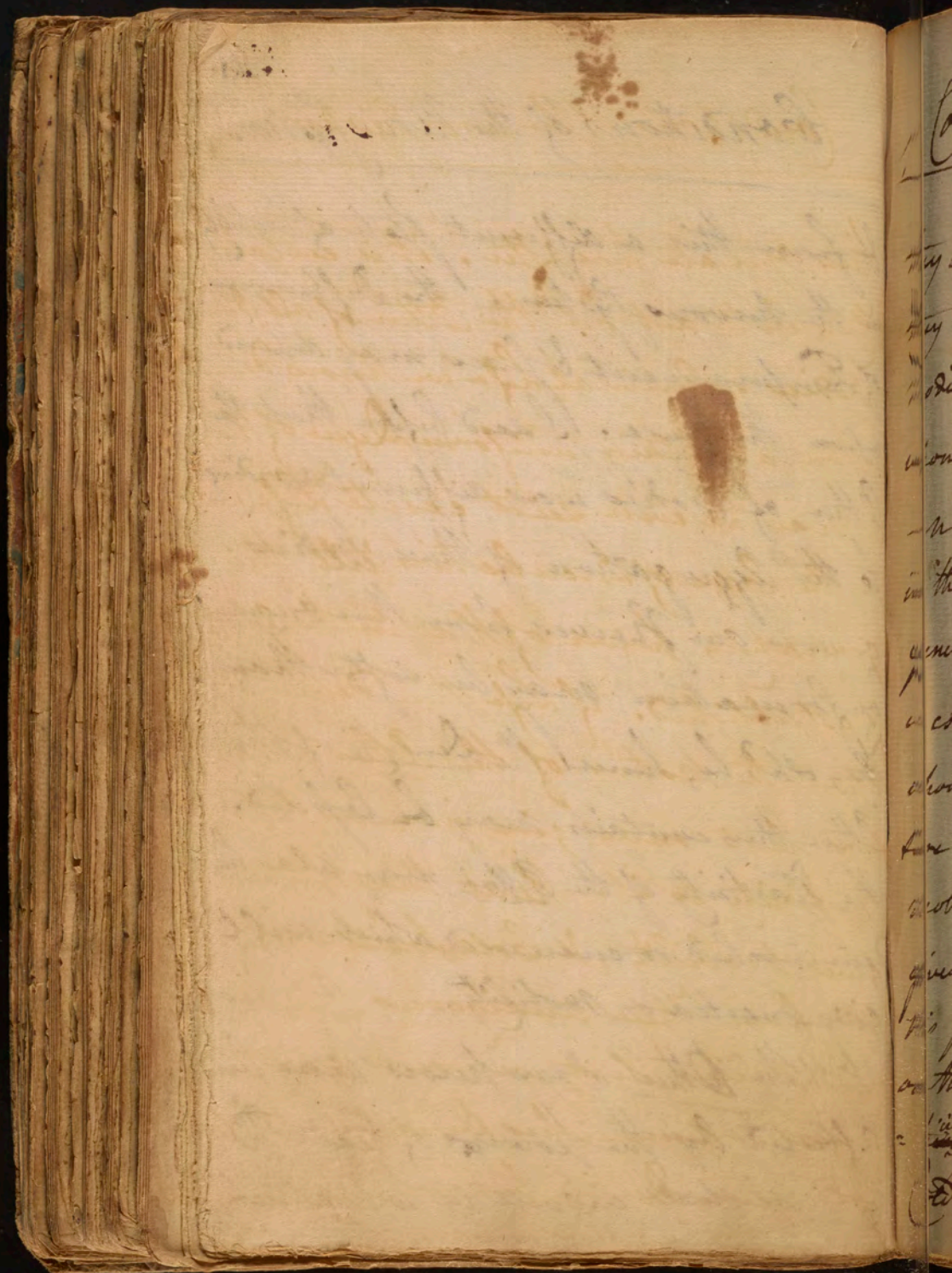
Conditions of the Nerv: system

It from this a different state of mobility
in the nervous system. the difference
of Temperament & Sexes may depend
upon this Cause. I said before that the
Ottor of Bodies was different according
to the Aggregation of these Bodies.

now our Nerves from their original
Conformation may be softer than
they sh^d be, hence the Density of the
Ottor they contain may be lessened.
the Elasticity of the Ottor may also be
diminished or increased which will
give Inertia or mobility.

(b) the Ottor of our nerves may be
affected by the powers of Heat & Cold.

- we shall enquire in what manner



Conditions of the Hero: System

they operate hereafter. it is certain
 they both act on the Other of all Other
 Bodies. Animal Life we know depends
 upon a certain uniform Degree of Heat.
 - nay we even see it excite Life as
 in the Case of Incubation till the
 generating power of Heat in the Animal
 is established. if Life then depends
 upon the motion of this Other we are
 sure Heat may give more or less
 mobility to it. Heat then I presume
 gives mobility, & Cold Inertia. I infer
 this from their analogous Operation
 on the Air. Heat we know gives El-
 -^{asticity} ~~tricity~~, & diminishes Density, while
 Cold gives Density, but not Elasticity

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123

Conditions of the new System

in proportion. Cold I know acts
as a stimulus, but we before hinted
that many bodies might act as
stimulants & sedatives. But why
is not the body heated in proportion
to the external heat applied? The heat
of the body is uniformly at 98° : nor
is it increased by a heat of the air
that rises up to 120° : Dr Lee found
by a number of Expts that the
heat ~~was~~ of frogs was always below
the temperature of ^{water or heat from here} ~~this medium~~. The
solution of this Problem is very dif-
ficult! Nor does the heat of the
body fall in proportion to external

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Conditions of the Nerv. System

Cold. The generation of Heat ~~the~~ we shall say hereafter depends upon the Oscillations of our nervous. ^{ch.} Others w: cannot be affected so as to produce more or less Heat by Heat or Cold. — an obvious Analogy borrowed from Electricity may serve to illustrate this Hypothesis. Sulphur is an Electric body while hard, but no sooner does it become soft than it loses its Heat & then transmits the Electric Fluid.

all Heat above 62° by increasing Elasticity gives Mobility. all Cold below 62° gives Density to the Other & hence induces Inertia. This is confirmed by the different Temperament of people

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125.

Conditions of the Nervous System

in warm & cold Climates.

(c) The Mobility of the Other may be affected by certain ~~external~~ Applications such as sedatives & narcotics, which act on the sensibility & irritability of the whole System from w^{ch}. Infer^{ly} it acts on the Other & not on the solid part of our nerves. I before hinted that sedatives act by abstracting Other from our nerves. but sedatives are of various kinds. Some of them may act more immediately upon the mobility of the Other in consequence of mixture, as acids & all corrosive substances w^{ch} appears from Dr Smith's Thesis. I much doubt whether there

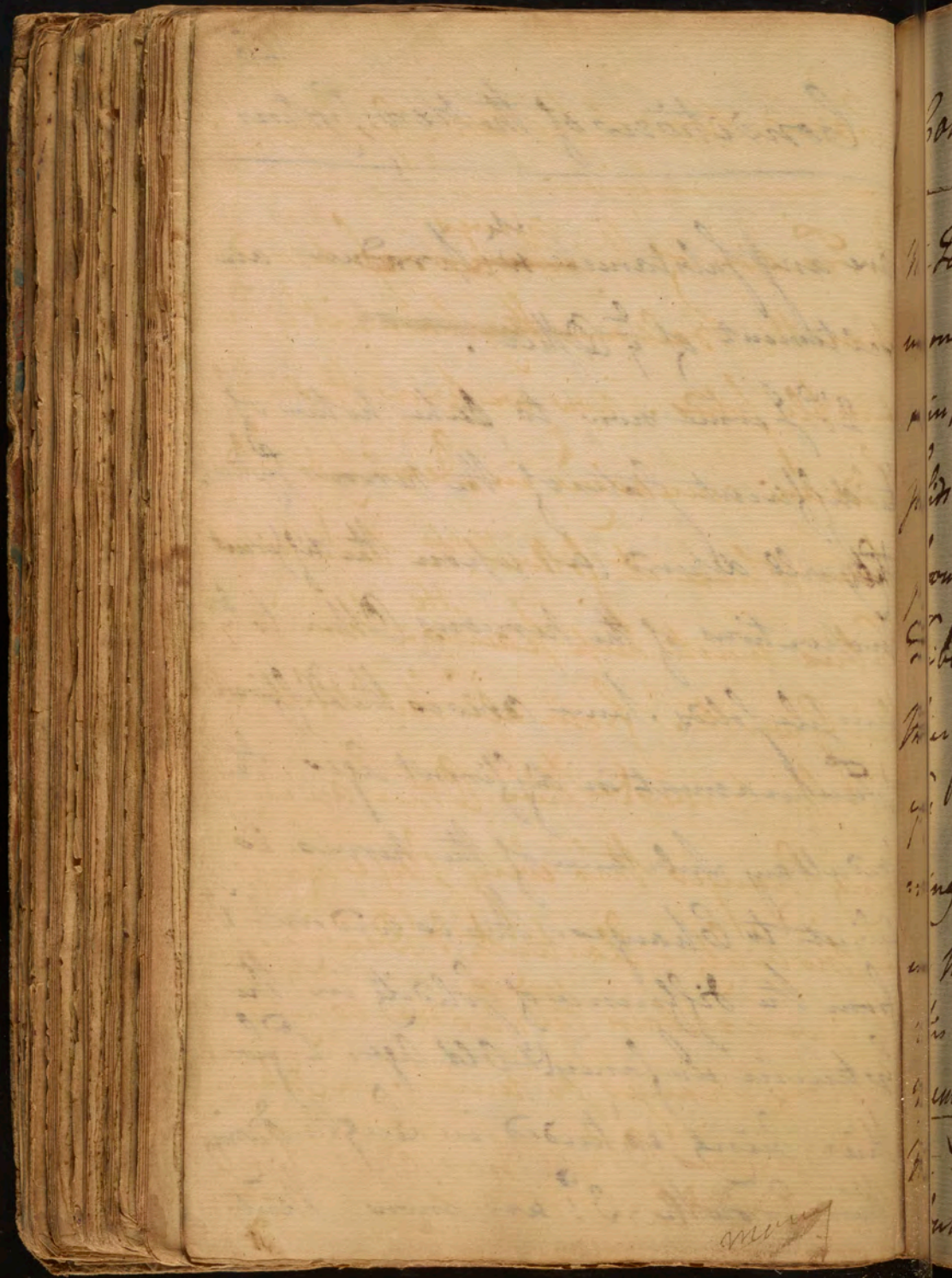
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Conditions of the Nerv: System

are any substances w^{ch} produce an
Excitement of $\frac{2}{9}$ Other.

2nd I come now to take notice of
the different states of the nervous system.
They will depend (a) upon the different
proportions of the nervous Other to $\frac{2}{9}$.
Simple solids. hence arises the Difference
of Temperament in different Ages. the
Medullary Substance of the nerves is
subject to Changes. This is evident 1st
from the Difference of solidity in the
System in Infancy & Old Age. 2^d from
their being extended in Length during
their Growth. 3^d we know that



Conditions of the Nerv: System

The Tension of the ^{nerves} ~~simples~~ depends
 upon the Ballance they have with the
 simple solids. now we know the simple
 solids are increasing in Density & solidity
 from whence it follows ^{that} the Nervous
 Fibres must keep pace wth them in
 their Growth. from all this it follows
 y^t the Nervous & the Other are suffer-
 ing Changes thro' every stage of life,
 in Mobility - Elasticity & Density. from
 this we explain the Reason why the
Memory changes so much. in Infancy
 the Nervous Other has great Platy
 but little Elasticity. & hence has

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Conditions of the Nerv: System

Small Oscillations ^c in Manhood & Elasticity & Density are in their perfect state. in Old Age they are diminished & hence the memory fails.

Let us now explain in wth Manner ^L
 the mobility of the System is affected by this Ballance between the vis nervosa & the simple Solids being destroyed. it will depend 1st upon ^L weight appended 2nd upon the contractility of the simple Solids. the weight ^L & Contractility of the Solids are always on ^L y increase from wth we infer the power of the vis nervosa must increase also. now

Consideration of the human condition

The human condition is a complex one, involving a variety of factors which influence our lives. These factors include the physical, the mental, the social, and the spiritual. Each of these factors plays a role in determining the quality of our lives, and it is the interplay of these factors which makes the human condition so fascinating and so challenging. We must therefore consider each of these factors in turn, and see how they interact with one another to shape our lives. The physical factor is the most obvious, for it is the foundation upon which we build our lives. Without a healthy body, we cannot function properly, and our lives are doomed to be a series of struggles and hardships. The mental factor is equally important, for it is the mind which directs our actions and determines our fate. A healthy mind is essential for a happy life, and it is the duty of each of us to cultivate and strengthen our minds. The social factor is also of great importance, for we are social creatures, and we cannot live in isolation. Our lives are shaped by the people we meet and the society in which we live. It is therefore our duty to live in harmony with others and to contribute to the well-being of our community. Finally, the spiritual factor is the most subtle, but it is also the most powerful. It is the spiritual factor which gives us meaning and purpose in life, and it is the spiritual factor which enables us to transcend the limitations of the physical and the mental. We must therefore strive to develop our spiritual lives, and to seek the truth which lies beyond the material world. Only in this way can we achieve the happiness and fulfillment which are the goals of all human beings.

Conditions of the Nerv. System

These do not always agree in proportion
 w: must give a Diff. of Mobility
 to the Nervous System. at a certain period
 in Life they both come to a Balance. When
 the Body ceases to grow, the vis nervea
 continues to increase in Density &
 Force. But we know there are many
 Causes w: induce Rigidity in the Solids
 in such manner that they overbalance
 the vis nervea as in Old Age. This bal-
 ance we have been talking on may be
 affected by all those Causes w: influence
 Tension.

(b) the state of the vis nervea may be
 affected by the Force of distending Fluids.

Conditions of the new system.

- The Arteries are always distended wth blood
 w^{ch} not only gives a tension to the
 Fibres of the Arteries but to Muscular
 Fibres in general. now the greater or
 less ^{of the blood} Infux will influence the state of
 tension in the ~~head~~ nerves. This Infux
 will depend upon the Force of the Heart,
 which during Infancy & Childhood is
 superior to the Resistance of the Solids,
 but this superior Force is constantly
 diminishing till it comes into ~~an~~ ex-
 act Balance wth the rest of the system
 at which time the Growth of the body
 ceases. in Old Age the Force of the
 Heart is inferior to the Resistance of

45

131

Conditions of the Nerv. System

the folds from whence arise ^a different
state of mobility in the Nervous System.

II. We shall now proceed to speak of
~~the~~ conditions of the several different
parts of the Nervous System, & 1st we
shall speak of the Sensorium ^{or} we shall
consider as the vis Animalis from its
Functions continuing during sleep &
waking. These alternate ^{or} another
very regularly every 24 hours, & are common
to the whole Animal Species. The common
Explanation of this is, ^{2^d} the Nervous Fluid
is secreted in the Brain ^{or} is dissipated
during the day by the vis Animalis, and
renewed again every night. But to this

Conditions of the Nerv. System.

we Objut that this Fluid is often expended
~~more~~ ^{much} faster than it could be secreted. Dr.
 Boerhaave insists much upon ^{the} glandular
 structure of the brain & hence concludes
 that some Fluid must be secreted there.
 - This I will not deny, But I hope we shall
 show hereafter another Use for the glandular
 structure & secretion w: ^{is} given in the
 brain, & that it cannot possibly be
 designed as the medium of sensation. For
 w: we said formerly the Ether is too subtle
 to admit of such a secretion, nor do we
 ever find any Respectables y: appear
 capable of confining such a subtle
 matter in the brain. But I add, that
 the Phenomena of the System in general,

Conditions of the new System

and especially of sleeping & waking are,
 by no means reconcilable to an alternate
 Exhaustion or Repletion of the
 nervous power. Its Inactivity may
 depend on many other causes than
 an Exhaustion of it such as want of rest
 - too much Rigidity in the solids &c.
 - the vis Insita remains so long in
 a muscle that we cannot reconcile
 it with an Exhaustion of it. Besides
 we see the Matter returned to the Brain
 to communicate Impression & not
 expended. I grant the vis Insita shows
 a weakness by Exercise, but this
 arises from a Diminution of ~~the~~
 its excited state, & not from its

Conditions of the Nerv: System

being exhausted ^{ed} w: we prove from our
being capable of exciting it when most
languid by Exercise.

Let us now attend to the phenomena
of Sleep. we indeed mark of Exhaustion
appear, but we find stimuli capable
of banishing a Disposition to Sleep.
- These stimuli cannot communicate
either to our nerves as we said before,
because we find mechan: Impulses
such as sound are capable of keeping
it off. we have a practice of striking
writters to extract Confusions from y:
in this Country, by which means we
have kept them Awake several weeks.

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Conditions of the nerv. System

now in these Cases there could be no Re-
pletion. Besides if Sleeping was unavoid-
able in consequence of Exhaustion
why is not waking the consequence
of Repletion? - for we find it is not,
- we are all capable of sleeping at
any time in certain circumstances of
Darkness - Silence &c. all the other
secretions when full, excite a stimulus
to discharge themselves, but we see
nothing of this kind in the nervous Ether.
- for waking returns only in consequence
of Habit or stimuli applied to y^e body.
we often see Instances of people who
can sleep 18 out of the 24 hours.
- now shall we ask for a Return

(a) we ought first to define sleep: it
is a Cessation of the Animal Functions

Conditions of the Nerv. System

of Sleeping & waking at periodical hours.
 - this they do, let ever such great thin-
 -ging or Exercise have preceded. Surely
 therefore no regular Exaustion can take
 place in these Cases. The periodical
 Habits depend on an Association of
 Ideas ~~not~~ or an Abundance of Stimuli
 & not on an Exaustion of the Nervous
 Matter.

But again we see some Animals
 sleep the whole winter - here the Tem-
 -perature of the Air only can ^{act} on
 the Matter. it is absurd to suppose a
 Secretion going on in their Brains
 during the whole winter.

On w: then does sleep depend? on
 an Interruption of Motion either

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Conditions of the nerv: System

1st on the sensorium 2nd on the
 mobility of the Matter of our nerves &
 3rd ~~on~~ Want of Impulse. — — —

I let us enquire into the different
 states of the sensorium & influence
 sleep. here we may include three
 possible Causes. 1st the sensorium may
 be in such a state as not to transmit
 Motions 2nd Supposing the motions con-
 tinuing free in the sensorium we ever shake
 the mobility of the nervous Fluid, on
 3rd on a want of Impulse on the
 nerves. Let us consider each of
 these separately. as to the 1st we often
 see a Loss of sense & motion to follow

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Conditions of the nerv: system

a Compression of the Brain which
 an Interruption of Motions was in-
 duced. ^{Some suppose that} ~~we doubt not that for~~

a light Compression of the Brain ^{this} always
 takes place in natural sleep. ~~But~~
^{must} it ~~may~~ be a compression of a peculiar
 nature or else it could not be remo-
 ved so suddenly upon waking. Upon

the whole I am apt to conclude Com-
 pression can have no Influence in indu-
 cing sleep. ^{maybe} sleep is ~~is~~ but only Conges-
 tion or Tumor in the Brain, but we
 cannot suppose sleep is occasioned
 by either of these in its nat: state.

I grant the Recumbent posture

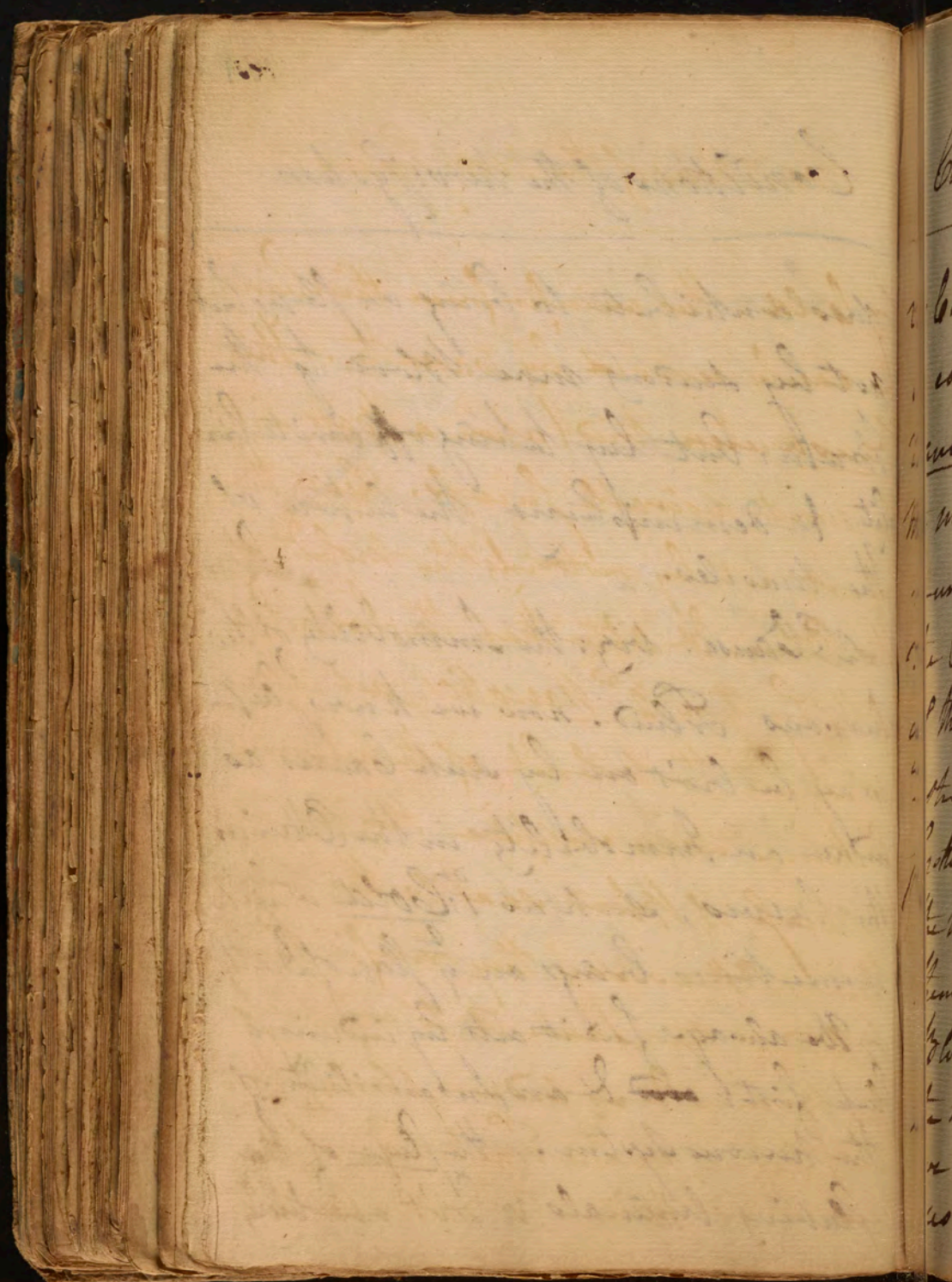
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Conditions of the Nerv: system

does contribute to bring on sleep, but not by sending more Blood to the Brain, but by taking off irritability & diminishing the action of the Muscles.

2nd Cause. viz: the Immobility of the nervous Fluid. now we know sleep may be bro't on by such Causes as induce an Immobility in the Matter of the Nerves, such as 1st Cold which sometimes brings on ² sleep of Death. - We always find it act by inducing sleep first, ~~and~~ & an Insensibility of the nervous system. the sleep of the sleeping animals is bro't on entirely



Conditions of the nerv. System

by Cold. This we infer from thickening
 so easily revived by warmth. This
Vanadictum tried upon a Ratt with
 the most desirable success. Heat then
 must act by restoring the mobility of
 the Other, & after that the Irritability
 of the System 2nd Narcotics act by de-
 -stroying the mobility of the nervous
 system. some suppose they act on
 the mass of blood so as to thicken
 them, Others say they rarify the
 blood & thus cause it to compress
 the brain & so induce sleep. But
 we have many facts w^h show
 us that they act directly upon^g.

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Conditions of the nerv: system

the nerves, & is too in proportion to the sensibility of the part they are applied to. I infer then that they act solely by destroying the mobility of the Nervous Fluid.. in witness I formerly hinted. But neither of these Causes can act in inducing natural periodical sleep. we must therefore seek for the Cause of ~~the~~ sleep in the IIIrd set of Causes viz: the want of Impulse Only. This appears to be the only true Cause of natural sleep. You may make a Person fall asleep at any time

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Conditions of the Nerv. System

by removing all Impression or Stimu-
 le from the Body and Agitation from
 the mind. we often find one single
 Impression will bring on sleep w:
 must be by taking off the Attention
 of the mind from every other Impres-
 sion. a hearty meal induces sleep
 only by occupying the Attention
 of the mind or stomach in Digestion.

— The Animal System is no Automation
 but requires external Impulses to keep
 it in Action. the Other is always ai-
 ming at an Equilibrium. but Im-
 pulses destroy it, now when they are

(as) the waking state appears to be
a state of violence kept up by stimuli.
Sleep appears to be the state of
the system to ^{wh} it is always tending.
- These stimuli are the causes which
keep the sensorium always in an ex-
cited state.

Conditions of the nerv. System

removed an Equilibrium or Rest
 is bro't on which tho it does not
 induce sleep itself, yet it disposes
 to it. as the Animal System requires to
 be constantly excited, & without Im-
 pulsive Life would soon be extinct. there
 must be something always to keep
 the Other in an excited state in wak-
 ing in the Brain, now when all
 Stimuli are removed the Brain
 collapses, or acquires a state of Im-
 mobility. it is easy now to conceive
 why the collapsed state of the Brain or
 sleep succeeds a want of Impulse.
 - all this corresponds strictly with

Conditions of the Nerv. System

the manner in w^h Cold & narcotics produce artificial sleep which I imagine to be by destroying the mobility of the Other & not by raising wth it. But a difficult Question occurs here. Why does a Disposition to sleep always follow Exercise? sh^d not Exercise act as a stimulant thus put off sleep? - This must be referred to a certain Law in our Constitution. Exercise when the Other is in an excited state diminishes its Excitability. Thus all stimuli we know after being long applied, loose their power of exciting motion, wth in owing (not to the fluid of the nerves being exhausted) but to its Excitability

Conditions of the Nerv. System

being destroyed. now all unrise
 whether of body or mind act in any same
 manner. This in my Opinion solves
 the Difficulty we proposed. What does
 waking depend on? 1st on the circ-
ulation of the blood in the brain,
 & a moderate Degree of Tension
 always keeping the Other in an excited
 state. This is the Reason why an
 increased Action of the Heart, could
 not prevent sleep by determining
 too much blood to the brain. There
 is another Cause of sleep th we did not
 mention viz: Heat. This when
 increased beyond 62° acts as a specific

(as the excitement in this case is so
high as to resist impressions.

Conditions of the nerv. System

either by taking off Tension, and lessening the generating power of heat in the body, or by acting on the surface of the body only, by receiving blood from the brain. Let us now enquire into the different Degrees of Excitement in the other. the highest degree of Excitement is in Maniaes. hence their prodigious strength, & their preference of Cold. ^{as} this is the most opposite Degree of Excitement to sleep. the 2nd Degree is ^{in the} y^o w: occurs in the Ordinary State of waking. this Degree may be subdivided several times according to the vigor or debility, gaiety, or

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Conditions of the Nerv. System

or Melancholly th Persons feel
 when Awake. a 3^d Degree is the state
 of Sleep. This also is ~~in~~ different in
 Degree. Thus those who dream have
 some of their Animal Functions perfect.
 This then is still a Degree of Excitement.
 + There is a constant Energy from
 the Sensorium in the waking state
 into all the Nerves. now in Dreams
 part of the Brain may remain un-
 collapsed, & those Animal Functions
th we see may proceed from that
 part of the Brain from whence
 their Nerves are derived nothing
 collapsed. all those Activities were

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Conditions of the Nerv. System

-mit during sleep never fatigue now:
is owing to them not being attended
to sensation or volition. This is
the Reason why the Heart is re-
-newed ^{the} w: Breathing. a 1st Degree is
Syncope.

a 5th is Death. Syncope depends on
a withdrawing of the exciting powers
as the Action of the Heart & Arteries
on the Brain. This we prove from
being prevented by keeping the
Body in a recumbent posture
Death depends on a Collapsion of
the Brain while the rest of the
System remains un hurt. This

1

Conditions of the Nerv. System

is evident in that Death ^{is} is produced
by Fear or Joy when in an Infant.

I think we might bring all the
Other Causes of Death to the same
principle. I shall now mention

the several exciting & collapsing
Causes of the Brain. The 1st exciting
Cause is Heat. This we prove from

the Sleeping Animals being colder
in winter ^{than} in $\frac{2}{4}$ Summer. 2nd Cause

is the Action of the Heart. 3rd The

Exercise of all the vital &
Natural Functions. 4th The Fusion
of the different parts of $\frac{2}{4}$ System ^{Depends}
= Living

as this is somewhat doubtful?

Conditions of the Nerv: System

either on the solids or fluids. this is evident from the remarkable Effects ⁱⁿ the Tension of some one part has when rendered tense by a full section as the seminal vesicles.

a 5.th Cause is, all the sources of Sensation

I mean direct sensations

a 6.th source is Reflex sensations or ^{ca} those w: are attended w: pleasure or pain.

a 7.th Cause may be a certain Condition of the Brain Altho we cannot pretend to explain it.

a 8.th exciting Cause is sleep. I said before that waking is a state of violence, kept up by stimuli. now sleep puts ^{into} the System into a more

(as upon this subject see D. Gambius
§ 523. & 524)

Conditions of the Nerv: System

excitable state, & restores the Excitability of the Other. Let us now enquire into those Causes w^h take off Excitability & bring on sleep.

1st is Cold. 2nd the weakened Action of the Heart 3rd the weakened Action of the vital & Animal Functions.

4th every thing y^t takes off Tension.

5th the Absence of ^{Sensations} ~~Sensations~~ not established necessarily by Habit, for the Absence of these excite the Brain.

6th ~~sedative~~ ~~and~~ direct Sensations.

7th sedative Impressions.

8th ^{some} ~~direct~~ Sensations y^e are reflex? -

9th Exercise. -

10 Compressions of the Brain. (2)

Conditions of the Nerv. System.

We come now to speak of the different states of the Nerves as enveloped in their particular membranes. They are liable to the conditions of being more or less fit to propagate motion. We know of no causes that can influence these but compression from Tumors or other causes.

- Compression may vary considerably & thus produce different Effects as in the numbness ^{ch} arises from compressing a nerve, and in a total Compression.

We go ~~on~~ on to speak of the different states of the sensitive Extremities.

- These are greatly varied, but depend more upon the apparatus contrived for receiving Impressions than

Conditions of the Nerv. System

upon the different state of $\frac{1}{2}$ nerves.
 - But the nerves are more or less
 sensible, as depending ^{1st} upon
 Habit - 2nd upon the state of Tension
 in Muscles from distending Fluids.
 an over-Tension we know increases
 Sensibility as in the Case of an Infla-
 mation of the Eye. I will not pretend to say
 a want of Tension diminishes Sensibility.
 3rd Upon the different states of Energy
 in the Sensorium. When this Energy is
 very strong it diminishes Sensibility &
 lessens the Force of Impressions as in
 the Case of Maniacs.
 4th Upon the Mobility of the Nervous
 Fluid w^{ch} we know differs in Temperaments

22

Conditions of the Nerv. System

Age & Sex, & may be varied likewise considerably by Poisons as in the Hydrophobia. We know of no stimulants ^{that} act directly upon the Sensorium, the only stimulants that act upon or excite the Sensorium are sedatives such as Wine & Opium.

Let us now enquire into the Conditions of the Moving Fibres. Their greater or lesser Irritability will depend first upon their Organization by w^{ch} I don't understand any difference in the ultimate Fibres of these Muscles, but a greater Irritability of them. This we see in all these Muscles w^{ch} are moved involuntarily, & is occasioned by their ^{being} formed sooner than the Organs

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Conditions of the Nerv. System

of the natural Functions. The vital Organs retaining their Irritability after Death while the Other Organs loose their Motion depends entirely upon the different Circumstances of Heat & Flexibility. The vital Muscles are moreover perf connected th cellular texture & consequently their Actions will continue more free after Death.

2nd Upon Repetition th always increases Irritability th may serve still further to cur: for the Heart retaining its Irritability longer than any Other Muscles after Death..

3rd Upon the Muscles being more or less exposed to various stimuli which give a greater or lesser Excitement to the Others.

Conditions of the Nerv. System

- 1.st Upon their greater or less Tension
 - When the Tension is increased too much it ~~excites~~ ^{depends upon 1st} the sensorium.
 - ~~Dep~~ this Tension may the Balance between the sensorium & the moving Extremities as we said before in explaining the difference of mobility in different Lys. 2.nd Upon the Balance between different muscles especially those w^{ch} are Antagonists.
 - hence we see the Reason why an Atonia follows ^{the want} of usual stimulus as in the Case of Dram-Drinking - lifting weights &c w^{ch} act by bringing on Tension & ^{an} Balance between the muscles.
- 5.th Upon the mobility of the nervous Fluid, hence we often (tho' not always) find it proportioned to Sensibility.
- 6.th Upon the Tension of the Arteries

The first of these is the
 fact that the power of the
 mind is not limited by the
 senses. The second is the
 fact that the mind is not
 limited by the body. The third
 is the fact that the mind is
 not limited by time. The fourth
 is the fact that the mind is
 not limited by space. The fifth
 is the fact that the mind is
 not limited by matter. The sixth
 is the fact that the mind is
 not limited by energy. The seventh
 is the fact that the mind is
 not limited by information. The eighth
 is the fact that the mind is
 not limited by knowledge. The ninth
 is the fact that the mind is
 not limited by wisdom. The tenth
 is the fact that the mind is
 not limited by power. The eleventh
 is the fact that the mind is
 not limited by glory. The twelfth
 is the fact that the mind is
 not limited by honor. The thirteenth
 is the fact that the mind is
 not limited by wealth. The fourteenth
 is the fact that the mind is
 not limited by health. The fifteenth
 is the fact that the mind is
 not limited by life. The sixteenth
 is the fact that the mind is
 not limited by death. The seventeenth
 is the fact that the mind is
 not limited by resurrection. The eighteenth
 is the fact that the mind is
 not limited by judgment. The nineteenth
 is the fact that the mind is
 not limited by reward. The twentieth
 is the fact that the mind is
 not limited by punishment. The twenty-first
 is the fact that the mind is
 not limited by heaven. The twenty-second
 is the fact that the mind is
 not limited by hell. The twenty-third
 is the fact that the mind is
 not limited by paradise. The twenty-fourth
 is the fact that the mind is
 not limited by purgatory. The twenty-fifth
 is the fact that the mind is
 not limited by the afterlife. The twenty-sixth
 is the fact that the mind is
 not limited by the soul. The twenty-seventh
 is the fact that the mind is
 not limited by the spirit. The twenty-eighth
 is the fact that the mind is
 not limited by the intellect. The twenty-ninth
 is the fact that the mind is
 not limited by the will. The thirtieth
 is the fact that the mind is
 not limited by the emotions. The thirty-first
 is the fact that the mind is
 not limited by the senses. The thirty-second
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 not limited by the body. The thirty-third
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 not limited by time. The thirty-fourth
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 not limited by power. The seventy-first
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 not limited by reward. The eightieth
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 not limited by punishment. The eighty-first
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 is the fact that the mind is
 not limited by hell. The eighty-third
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 not limited by paradise. The eighty-fourth
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 not limited by purgatory. The eighty-fifth
 is the fact that the mind is
 not limited by the afterlife. The eighty-sixth
 is the fact that the mind is
 not limited by the soul. The eighty-seventh
 is the fact that the mind is
 not limited by the spirit. The eighty-eighth
 is the fact that the mind is
 not limited by the intellect. The eighty-ninth
 is the fact that the mind is
 not limited by the will. The ninetieth
 is the fact that the mind is
 not limited by the emotions. The ninety-first
 is the fact that the mind is
 not limited by the senses. The ninety-second
 is the fact that the mind is
 not limited by the body. The ninety-third
 is the fact that the mind is
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 not limited by space. The ninety-fifth
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 not limited by matter. The ninety-sixth
 is the fact that the mind is
 not limited by energy. The ninety-seventh
 is the fact that the mind is
 not limited by information. The ninety-eighth
 is the fact that the mind is
 not limited by knowledge. The ninety-ninth
 is the fact that the mind is
 not limited by wisdom. The hundredth
 is the fact that the mind is
 not limited by power.

Conditions of the Nerv. System

we have nothing⁺ to act against them but the blood. Their Tension therefore will depend 1st upon the Quantity of blood in the body - 2nd upon the difference of ^{its} Distribution - 3rd upon the greater or less Resistance of the veins, 4th upon the Force of the Heart 5th upon the Resistance of the Arteries & themselves.

Tension therefore varies in the Arteries in different stages of Life, as we explained at some length formerly.

6th upon the pressure of the surrounding Atmosphere, 7th upon the Changes of Heat & Cold. 8th upon the Determination of the blood up to the surface of the body.

From w^h has been said concerning

[Faint, illegible handwriting in a cursive script, likely from an 18th-century manuscript. The text is written in dark ink on aged, yellowed paper. The handwriting is dense and fills most of the page, though some lines are faded or obscured by stains. The left edge of the page shows the binding of the book.]

[Partial view of the adjacent page on the right, showing faint handwriting.]

Conditions of the Nerv. System

the different states of the Arteries we may readily see the Cause of a Plethora ^{is} depends upon a laxity of the Arterial System ^{which} gives way to the Accumulation of Blood. When this is the case the Irritability of the System is increased & hence arises the Frequency of Hemorrhages in plethoric Persons.

I go on to speak of the Changes of the alimentary Canal & 1st of the Stomach the Tension of ^{the} w depends 1st upon the state of Energy in the Sensorium 2nd upon ^{the} state of dis-
tending powers 3rd upon ~~power~~ Stimulus

[The page contains extremely faint, illegible handwriting, likely bleed-through from the reverse side.]

Conditions of the Nervous System

power applied to it. 1st a great degree of Energy from the sensorium is necessary to the stomach so y² general changes in the nervous system have a power of influencing its Tension.

2nd It is surprising to see in different states of Tension it is capable of from Aliment taken in. the Blood w^{ch} it contains likewise tends to influence its Tension considerably as it is more or less in Quantity.

3rd Its Tension is much varied from Impressions made on it as a sentient & irritable Organ by the great

Handwritten text in a cursive script, likely from a 17th or 18th-century manuscript. The text is written in dark ink on aged, yellowed paper. The handwriting is somewhat faded and the ink is uneven. The text appears to be a single paragraph or a list of items, but the specific words are difficult to decipher due to the cursive style and fading. The text is arranged in approximately 15 lines across the page.

Handwritten text visible on the right edge of the page, continuing from the previous page. The text is also in cursive and includes words like "From", "King", "Photo", "to", "of", "L", "cup", "atto", "L", "the", "atto", "P", "pro", "the", "in".

Conditions of the Nervous System

Variety in Food - Medicine - & other things accidentally taken in. Upon ^e whole the stomach is subject to the greatest Change in its state of Tension of any part of the Body except the Pericardium, & has the most extensive Connection th w: the rest of the System. w: has been said of the stomach will apply to all the Intestines.

But again the Muscular Fibres of ^e Bronchio are capable of great variety in their Tension from Changes in the Air & other Causes. in a word, every

[Faint, mostly illegible handwritten text in cursive script, spanning approximately 12 lines across the page. The ink is light and the paper shows signs of age and staining.]

[Partial view of the adjacent page on the right, showing handwritten text in cursive script. Legible fragments include:]

- coll
- to h
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- to
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- 1.
- may
- is a

Conditions of the Hero: System

hollow vessel in the system is liable to have its state of Tension varied by some of the Causes we have mentioned, such as the Glands - Lymphatics &c. But these cannot be the Subject of our Inquiry here. I must leave them to your own Inquiry. -

We come now to treat of the much talked off: Sympathy. a Term ^{of} is often used with Ambiguity!

The Heroic System is a continued Mass of Matter by w^h means it is adapted to communicate Motion

[Faint, illegible handwriting in cursive script, likely a letter or manuscript page.]

of Sympathy

to all its different parts. This is w^h has
 been called Sympathy, & has been re-
 solved into some inexplicable Connexion
 between one part & another. When we
 enquire into the Cause of Sympathies
 we shall find they evidently depend upon
 a Communication of Motion. I observe
 then that Sympathy has been distinguished
 into general & particular. By
 the first I mean those Communications
 of Motion w^{ch} affect the whole system.
 - thus Epilepsy is supposed to excite
 general Sympathy from the Degree
 of Stimulus w^{ch} brings it on, & not

[Faint, illegible handwriting in a cursive script, likely from the 18th or 19th century. The text is written in dark ink on aged, yellowed paper.]

from a general Relation be-
 the part impressed & the whole ^{as y}
 - thus the Sight or Touch of a person ^{just in}
 induces Paleness, not from any
 Connection between the parts affec-
 -ted but from a Communication establish-
 in the Brain. in all Cases of this ~~kind~~
 kind I think the Term Sympathy is
 improper, as the Facts we have menti-
 -oned all depend on nothing but a Commu-
 -nication of Motion. But when we see
 Motion excited in one part only pretty
 uniformly by the same Impression
 we call this particular Sympathy.
 - thus the ^{stir} of the a File very

ca, If right from Sympathy all these
w^{ch} arise from Imitation, such as
Yawning from seeing another
Person yawn. &c

of Sympathy

uniformly excites an uneasy
 Sensation in the Teeth, & cold Feet in
 some Constitutions very generally
 induce a Colic. But may not all
 particular Sympathies be reduced
 to the general Sympathy? I believe
 there are few of those Sympathies enumer-
 ated by Dr. Whytt but w^h may be reduced
 to this Head. 2^d we reject all those ~~sympa-~~
^(a)
~~these~~ motions w^h are the consequence of
 Habit & Association from particular
 Sympathy as many of them are arbitrary
 & may be laid aside at pleasure.
 But again I reject all those motions
 from Sympathy w^h succeed & thus

Handwritten title or header at the top of the page, possibly "The History of the County of York".

Main body of handwritten text, consisting of approximately 15 lines of cursive script. The text is significantly faded and difficult to decipher, but appears to be a continuous narrative or list.

Partial view of handwritten text from the adjacent page on the right, showing the continuation of the cursive script.

of Sympathy

165

produce one another. thus we often
see the Oesophagus affected ⁱⁿ with a Spasm
from an original affection of the
Intestines being propagated upwards
without any kind of Sympathy. all the
particular Sympathies may be reduced
to general Sympathy & depend upon an
affection of the whole nervous System, as
we see some of them bro't on by a variety
of different causes. thus we find a Locked Jaw
bro't on by a wound in any Tendon of the
Body. Sympathy means no more than
Q: a mutual action between the several
parts of the System. ^{ch} w: implies ² that
itself without assigning any Cause.

Of Sympathy

- Sympathy is improperly applied when we speak of the mutual action of the Brain & every other part of ^{the} System.
- we had much better speak of Mutual Action arising from Impression & Volition. Another Cause of Sympathy has been derived from the Anastomoses of Nerves independant of the Intervention of the Sensorium, but Dr. Wight has fully proved that there is no Foundation for such Sympathies.
- It is evident still further when we attend ^{to} the distinct nature of our sensations that we could not be

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[The main body of the page contains several lines of extremely faint, illegible handwritten text. The ink is very light and the script is cursive.]

[Faint handwritten text visible on the right edge of the page, likely from the reverse side or an adjacent page.]

Sympathy

the case if the nerves are cut.

2nd: It is evident from motions not being communicated laterally to any muscle on ^{the} side: the impressions are made.

3rd: In many cases where we think we see a communication of nerves, this communication disappears when the connection ^{with} the sensorium is cut off.

4th: Communications ^{of motion} are abundant in many places without any communication of nerves.

5th: In those cases where the nerves do communicate we prove the motion must be excited thro' the brain.

September

The first of the month was a day of
rest and quietude. The weather was
very pleasant and the wind was
light and fresh. The sun was
bright and the air was clear.
The water was calm and the
sky was blue. The birds were
singing and the flowers were
in bloom. The day was
very pleasant and the
weather was very good.
The first of the month was a day
of rest and quietude. The weather
was very pleasant and the wind
was light and fresh. The sun was
bright and the air was clear.
The water was calm and the
sky was blue. The birds were
singing and the flowers were
in bloom. The day was
very pleasant and the
weather was very good.

Sympathy

by motions being taken off from
 them by surgical Impressions made on
 the Brain. all these Argum^{ts}: suf-
 ficiently prove that no Sympathies can
 depend upon the Anastomoses of
 nerves independant of the action of the
 Brain.

all Connections of motions are attended
 wth: Sensation - Propensity - or volition
 so that I am ready to Doubt ^{that} ~~the~~ instinctive
al Actions do not depend on Anasta-
^{sis}
 no of nerves in the Brain, but are all of
 them originally more or less arbitrary.
 - But Dont we sometimes see
 Connections of motions where no

Proposals

of the Society of Friends
to the General Assembly
of the Province of Pennsylvania
in the Year 1740
The following is a list of the
names of the members of the
Society of Friends who
were present at the
meeting of the General
Assembly on the 1st of
October 1740
The names of the members
of the Society of Friends
who were present at the
meeting of the General
Assembly on the 1st of
October 1740
The names of the members
of the Society of Friends
who were present at the
meeting of the General
Assembly on the 1st of
October 1740

of Sympathy

165

Consciousness - or volition do
attend? This we must grant but
with this Restriction that they
were originally attended with
Sensation - & Propensity or volition.
- this becoming insensible is the
Consequence of Habit.

But to all we have said I must add
that there are Connections of motions
y: do not depend upon the Intervention
of the Brain. as the pain in the Teeth
from the noise of a File, w: depends
upon motion communicated directly
thro the bones from the Jaw to y. Jaw.

of Sympathy

- even soft parts & are capable of propagating Oscillations as well as bones. This is illustrated from the Case of Naw Voerhaave who is capable of distinguishing sounds by his Fingers. Inflammation is often propagated merely by the Communication of blood vessels. There is likewise a Continuity of Membranes w: ^{the} Propagation of motion, as in those pains w: ^{the} are felt in the Glands Penis from a stone in the Bladder. This finishes our Account of the Nerv: System.

Circulation of the Blood

This Subject has attracted the Attention
of Physiologists for upwards of three
hundred years. in treating of it I shall

1st ^{ch} Speak of the several Cavities in
w: the Blood is contained.

2nd of the Course of the Blood.

3rd of the Powers w: move it &

4th Some general Laws w: regard
the Circulation.

1st of the several Cavities are the
Heart - Arteries - Veins &c.

2nd First of the Heart. I suppose here

3rd you are all acquainted with

[Faint, illegible handwriting, likely bleed-through from the reverse side of the page.]

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Circulation of the blood.

its Anatomical structure. I shall only observe γ it is a hollow viscus consisting of 2 principal ventricles ^{the} w: 2 hollow Appendages called Auricles, & that it is fist to the Arteries & Veins. These Auricles & Ventricles consist of Muscular Fibres which run in various Directions. They are dilatatable & contractable to such a Degree as entirely to destroy their Cavity, & press out every Drop of Blood from them. 2.^d let us now consider the Arteries. They are formed of different substances th w: are applied to each Other in γ Form

Circulation of the Blood

of Layers. they consist of 3 Coats. the
external ^{is} is of a cellular Texture
 — the muscular ^{is} is of so compact
 a nature as to resemble a tendi-
 nous or ligamentous Coat. upon this
 but Dr. Hunter denies its being possess-
 ed of Irritability but some later
 Experiments prove this Opinion to be
 False. within the muscular Coat
 is another smooth polished Coat for
 an Art. of ^{is} see Anatomical Authors.
 — the Strength of the Arteries is
 very great ^{is} w: appears from the

Continuation of the History

The first part of the History is divided into three
books. The first book contains the History of the
first part of the reign of King Henry the First.
The second book contains the History of the
second part of the reign of King Henry the First.
The third book contains the History of the
third part of the reign of King Henry the First.
The fourth book contains the History of the
fourth part of the reign of King Henry the First.
The fifth book contains the History of the
fifth part of the reign of King Henry the First.
The sixth book contains the History of the
sixth part of the reign of King Henry the First.
The seventh book contains the History of the
seventh part of the reign of King Henry the First.
The eighth book contains the History of the
eighth part of the reign of King Henry the First.
The ninth book contains the History of the
ninth part of the reign of King Henry the First.
The tenth book contains the History of the
tenth part of the reign of King Henry the First.

Circulation of the Blood

Resistance ^{they are} capable of over-
coming. we have but few Experiments
to show ^{that} the relative Force of the
Arteries in different Sexes Ages
& Animals. Dr. Warrington found
a Force of 157 necessary to break
the Aorta of a young man. he thinks
the absolute as well as relative
Force of the Arteries increases as
you recede from the Heart, but his
Experiments do not ascertain that
this Force is exactly proportioned
to the distance from the Heart. the

(a) I believe in general they are nearly the
same altho' they admit of great variety.

of the Circulation of $\frac{2}{3}$ Blood

Specific Gravity of the Arteries we know increases as we recede from the Heart. The thickness of the Arteries always diminishes in proportion to their Area, but then their Density increases & with this Density their Force likewise. The Form of the Arteries when distended wth Fluid is always circular. They are in general cylindrical & not conical as was formerly supposed. This we prove from the Branches of Arteries being always larger than the Artery from whence they came, or exactly of the same Size.

[Faint, illegible handwriting in cursive script, likely a letter or manuscript page.]

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Circulation of the Blood

The Course of the Arteries is seldom in a straight Line, but almost always in a flexuous or winding Form especially in those parts where they are sending off frequent Ramifications. all branches go off from Arteries at acute Angles. we know of none that go off at Obtuse Angles. upon the whole much more has been said upon this Subject than has been useful or proper.

The Terminations of the Arteries are of 3 kinds. 1st into Veins by the Reflection of the Arteries 2^d into Cavities into w^{ch} they pour red Blood from whence it is again absorbed by Veins as in the

[Faint, illegible handwriting on aged paper]

[Faint handwriting visible on the right edge of the page]

Circulation of the Blood.

Corpora Cavernosa Penis &c. 3^d:
 into Serous Arteries or Arteries secundae
 - de generis i.e. vessels w^{ch} do not
 convey ~~red~~ Globules. These Serous
 Arteries terminate in Serous Veins
 or in Secretory vessels or in Open Arteries
 - ties as in the Uterus &c. into w^{ch} I
 believe ^{the fluid matter found there} it is exhaled in the form of
 Vapour. The Arteries have hundred
 lay out this, but I imagin^{the} w^{ch} no kind
 of Propriety.

The next Cavity ^{1st} contains Blood
 are the Veins. have they muscular
 Coats? - I think an Obvious Layer
 of Muscles may be distinguished

10

Circulation of the Blood

near the Heart a considerable Distance below the venous sinuses. Till some more Experiments are made on Irritability - I think we may infer a priori that most of the veins are composed of Muscular Coats except the very small Branches. The Density of the veins is always greater than their corresponding Arteries, & this like the Density of the Arteries increases as you recede from the Heart. The veins according to some Anatomists are larger ⁿ than their corresponding Arteries, & are more in Number, but w^t distinguish

[Faint, illegible handwriting, likely bleed-through from the reverse side of the page.]

Circulation of the Blood

them most from Arteries is their
 valves. They all take their Rise
 1st from red Arteries 2nd from Serous
 Arteries & 3rd from Absorbent Vessels
 as in the *Cavernosa Penis* &c.
 Where the Blood is effused from the
 Arteries, & afterwards absorbed by
 veins without any immediate Com-
 munication. even Lymph may
 in some Cases be absorbed by the
 veins as in the Brain where no
 Lymphatic Vessels have ever been
 discovered. we find also in many
 Cases as in *Echymosis* where

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Circulation of the Blood

there is an Effusion of Blood, it is all absorbed in a very short time. Surely the veins must be employed chiefly for this purpose. This finishes our list of the Cavities in w^{ch} the blood is contained.

II Let us now take notice of the course the blood observes in the circulation.

- Let us suppose it filling the right ventricle of the heart. from this it is propelled into the Pulmonary Artery from w^{ch} it is absorbed by the pulmonary veins & carried into the left Auricle & ventricle, from whence it

[Faint, illegible handwriting in a cursive script, likely from a 17th or 18th-century manuscript. The text is written in brown ink on aged, yellowed paper. The handwriting is dense and fills most of the page, with some lines appearing more distinct than others. The left edge of the page shows the binding of the book.]

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Circulation of the Blood

is propelled by the contraction of the Heart into the Aorta which distributes it to every part of the body from whence it is returned by veins into the Cava & right ventricle where we first found it.

We prove this to be the course of the blood 1st from Hemorrhages or Transfusions which deprive all parts of the body alike of blood, 2nd from the Situation - Structure & Functions of the valves of the Heart w^{ch} admit of the blood's passage only in One

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Main body of handwritten text in a cursive script, consisting of several lines of text that are mostly illegible due to fading and bleed-through from the reverse side.

Partial view of handwritten text on the adjacent page, including words like "way", "and", "to", "the", "his", "to", "di", "h".

Circulation of the Blood

way. 3.rd from Ligatures which
 cause the veins to swell below them,
 & when very tight cause the Arteries
 to swell above them. 4.th from the
 structure of the valves of the veins
 wh^{ch} admit the blood only in one way.

5.th from the continuation of Arteries
 & veins being demonstrated by Injec-
 tions & Microscopes. You all know that
 this 6.th of the Circulation applies only
 to Adults, the blood circulates in a
 different manner in ~~the~~ ^{the Fetus} as
 we shall say hereafter.

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Circulation of the Blood

The Motion of the two Ventricles of the Heart is Synchronous as appears from a number of Experiments notwithstanding the contrary has been asserted by Dr. Nicholls & Others.

III. I shall now enquire into those powers by w^{ch} the Blood is moved.

The 1st of these is Obviously the Heart w^{ch} some have supposed to be the only One. its power consists in its Muscular Contraction. But w^h is it y^t excites this Muscular Action? by either a vis inwards or a Stimulus applied to the Heart itself! the Stimuli

[Faint, illegible handwriting on aged paper, likely bleed-through from the reverse side. The text is arranged in several horizontal lines across the page.]

[Partial view of the adjacent page on the right, showing handwritten text in cursive script.]

Circulation of the Blood

applied directly to the Heart are of
 two kinds 1 Distention or 2 acid
 Substances these are again divided
 into Mechanical & Chemical. No one
 has yet proved that Mechanical sti-
 muli are applied to the Heart, nor can
 I think there is any thing like a
 Chemical stimulus applied to the
 Heart. for the Blood we know con-
 tains nothing acid in it, & Suppo-
 sing it did the Heart by Length of time
 would loose its sensibility to it. I
 therefore imagine that Distention
 from the venous Blood only acts
 as a stimulus on the Heart.

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Circulation of the Blood

There is likewise a considerable Influx
 of the vis nervosa into the Heart in
 common w: all muscles, & upon
 this Influx the Stimulus of Disten-
 -tion depends. This is sufficiently pro-
 -ved from the Effects of Passions which
 we know are capable of increasing
 the Action of the Heart. This you may
 remember gave Rise ^{to} our Con-
 -jecture of the Hearts being a Volun-
 -tary Muscle. What is the Force ^{the} w:
^{the} the Heart contracts? - did the
 Circulation of the Blood depend
 alone on this, the Question would

[Faint, illegible handwriting in a cursive script, likely from the 18th or 19th century. The text is written in dark ink on aged, yellowed paper. The handwriting is very light and difficult to decipher.]

[Partial view of the adjacent page, showing the right edge of the handwriting.]

Circulation of the Blood

be of some consequence, but this we know is not the case. I would therefore reject all the solutions that have been given to this Proposition by the Physiologists & Mathematicians. - we find them almost all differ in their Calculations. most of them have exalted it too high. in a word the Data on w^{ch} they found their Calculi are not to be admitted. Another question occurs here & that is wth wth velocity does the Blood move from the left ^{Ventricle} Auricle to the Aorta? - this might be determined could we tell;

[Faint, illegible handwriting on aged paper, likely bleed-through from the reverse side. The text is arranged in approximately 15 horizontal lines.]

[Partial view of the adjacent page on the right, showing handwritten text in cursive script.]

Circulation of the Blood

exact Area of the Aorta, with the
 Size of the ventricle. ~~we might give~~
~~and reason to~~ But no Physiologists
 have yet agreed in their Account of
 this. in some Men it may be greater
 than in Others. so that I think each
 of these two Problems are equally
 undetermined. on ^{it} does the Alter-
 nate Contraction & Dilatation of the
 Heart depend? - not on the Influx
 of Arterious Blood, nor yet upon a
 Reflex of the nerves of the Heart. the
 Only Cause appears to be the Influx
 of the venous Blood ^{ch} is Alternately
 applied & removed, there is a pump
 - lian

(a) The Arguments Agst the prodigi-
ous Force of these 8 Resistances may
be seen in the notes of last year
upon the same subject. —

Circulation of the Blood

Structure of the Muscles of the Heart
 is disposed to alternate Con-
 traction & Dilation. by the Heart

The Resistance to be overcome are

- 1 Elasticity of the Arteries
- 2 the Pressure of the Atmosphere
- 3 Quantity of the Blood to be moved.
- 4 Enlargement of the Arteries as they
 move from the Heart.
- 5: Terms & Angles of $\frac{1}{2}$ Arteries.
- 6: the Effects of Anastomosis. (as)
- 7: the Friction of the Blood upon the Ar-
 teries ^{ch} is supposed to be the most
 considerable Resistance. but the
 Resistance arising from the Action of

[Faint, illegible handwriting in a cursive script, likely from a 17th or 18th-century manuscript. The text is written in dark ink on aged, yellowed paper. The handwriting is dense and fills most of the page, though some lines are more faded than others. The left edge of the page shows the binding of the book.]

[Partial view of the adjacent page, showing the right edge of the text block. The handwriting is consistent with the main page.]
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Circulation of the Blood

Fluid on solids is so inconsiderable as not to deserve mentioning.

8: ~~for~~ The viscosity of the blood. but this has been unjustly accused. all viscosity is obliterated by the heat of ^{the} Body. — the component parts of the blood are in a diffused state, & upon this its permanent fluidity depends. thus have I enumerated all the Resistances the Heart has to overcome. but they are by no means so great as has been supposed, nor can they be subjected to any regular Calculation. they do however retard & resist the action

(a) Such as Dr. Nicholas - Dr. Hunter
& Dr. Hallen.

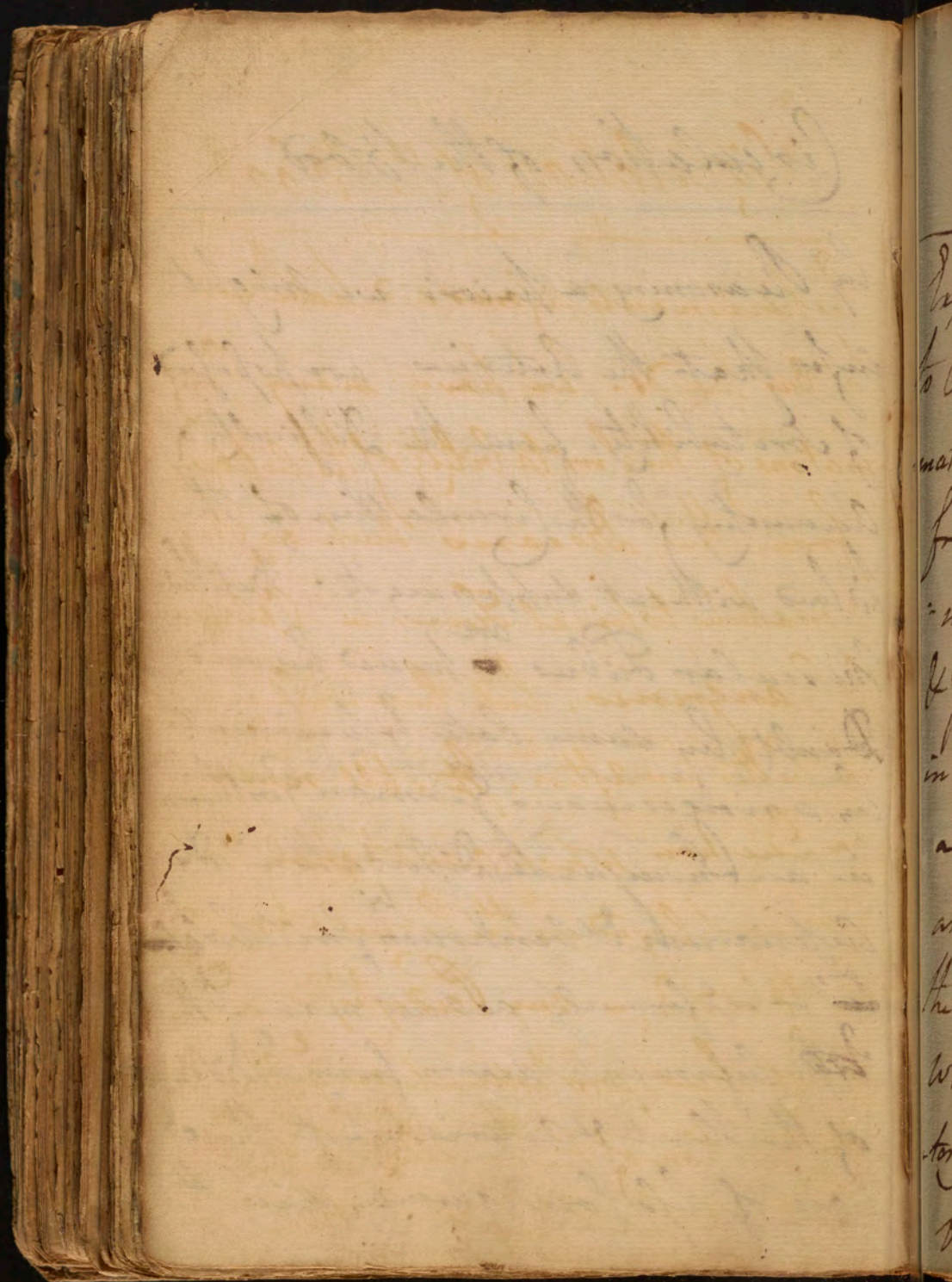
Circulation of the Blood

of the heart ^a little, & that to such
 a Degree that I think we must call
 in some Other power to aid: for
 the Force & Velocity of the Blood
 besides the Action of the Heart. This
 power then is the Action of the Arteries.
 Physiologists have Objected to this
 because they have not been able to
 discover Muscular Fibres in the
 Arteries, but later Observations have
 shown them to us tho in a more
 compact & apparently Cartilagi-
 nous state in all the Arteries. I think

as M^r. Vassieur was a stud^t in
this University. —

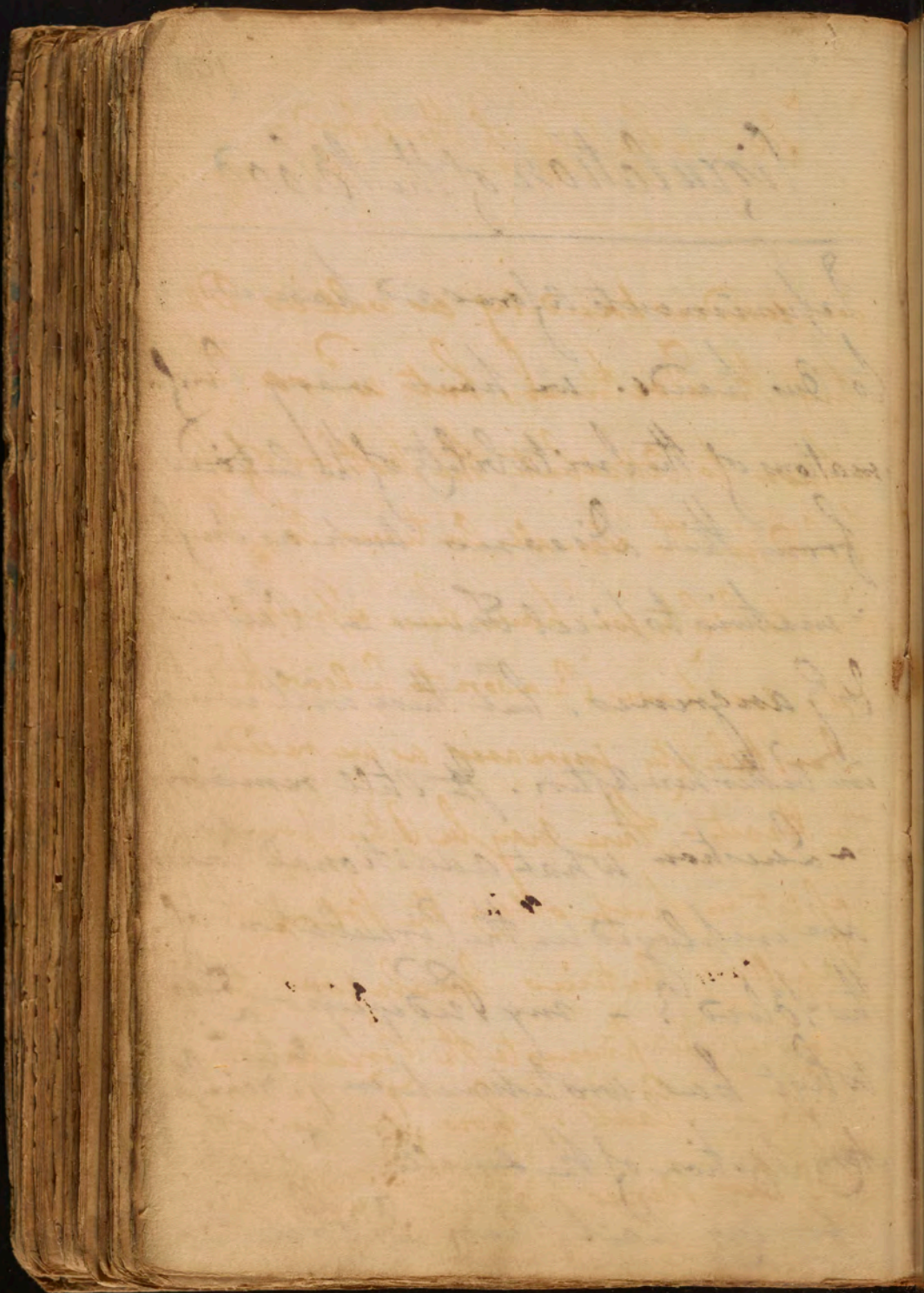
Circulation of the Blood

by Reasoning a priori we might infer that the Arteries are possessed of Irritability, from the Difficulty of accounting for the Circulation of the Blood without supposing it. But their Muscular Fibres ^{are} proved beyond Doubt by some late Experiments by an ingenious German Gentleman in an inaugural Dissertation "De Arteriarum & Venarum ^{vi} Irritabilitate" —. I formerly adduced many other ~~the~~ arguments drawn from Diseases of the Heart & Arteries, but these are of less consequence, since the



Circulation of the Blood

Experiments aforesaid have come
 to Our hands. we have many Confir-
 mations of the Irritability of the Arteries
 from their Diseases such as Infla-
 -mations topical Swells - Pulsies
 & Gangrenes, but these will come
 in better hereafter. It still remains
 a Question what additional powers
 are employed in the Circulation of
 the Blood? - my Predecessor Dr.
 Whist has wrote much on y^e Oscilla-
 tory Motion of the smaller Arteries.
 for my part I have Difficulties



194

Circulation of the Blood.

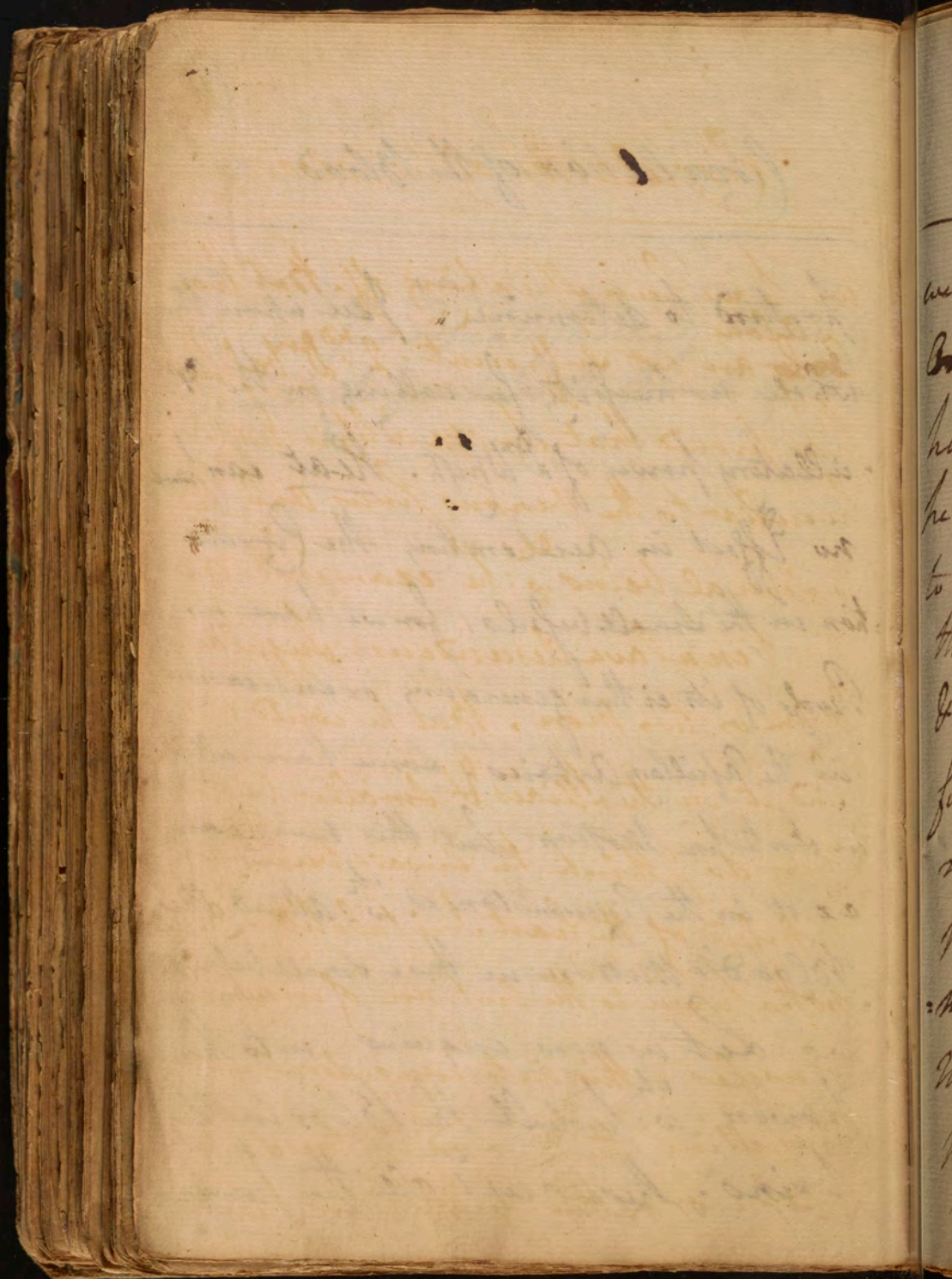
in understanding as well as Admit-
ting this Doctrine, but w^h? rather
choose to Attribute the Motion of the
Blood in the small Arteries to the
Irritability we have been speaking
off. we have Reason to believe that this
Irritability increases as we recede from
the Heart. There may be other powers w^h
assist in pushing the Blood thro^gh
Capillary Arteries Analogous to those
powers w^h promote the Circulation of
Sap in Plants. how far the Action
of our Venues may act I will not

(a) we find repeated shocks of Electricity
promotes & quickens the Growth of Plants.

Circulation of the Blood

pretend to determine. I see upon the whole no necessity for calling in the oscillatory power of Dr. Whijt. Heat can have no Effect in accelerating the Circulation in the small vessels, for we have no Proofs of its either generating or encreasing in the Capillary Arteries. Some have called in Intestine Motion, but this never can exist in the Circumstances ⁱⁿ attend the Blood's Motion in these small vessels.

Let us now enquire into those powers ⁱⁿ w: propel the Blood in the veins. These are ^{all} the powers



Circulation of the blood

we have been speaking of. But these
^{alone}
~~only~~ are not sufficient. 2nd Dr Valsper
 has proved that Irritability is not
 peculiar to the venous sinus only but,
 to several veins ^{ch} as he examined as
 the Vena cava descendens - Jugulars
 & one or two more. But he could not
 find it in the Iliacs & smaller veins.
 nor do I think the small veins are
 possessed of the least Irritability. 3rd
 another power is the contraction of incumbent
 muscles - this acts considerably in
 propelling the blood in the small
 vessels or rather chiefly, for I cannot

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Circulation of the Blood

conceive of any other auxiliary power
4th The Alternate Action of the
Diaphragm in Respiration contributes
to propel the Blood thro' the Liver where
it is most apt to stagnate. we shall
therefore proceed to speak of Respiration
& its Action in propelling the Blood
thro' the Lungs.

10
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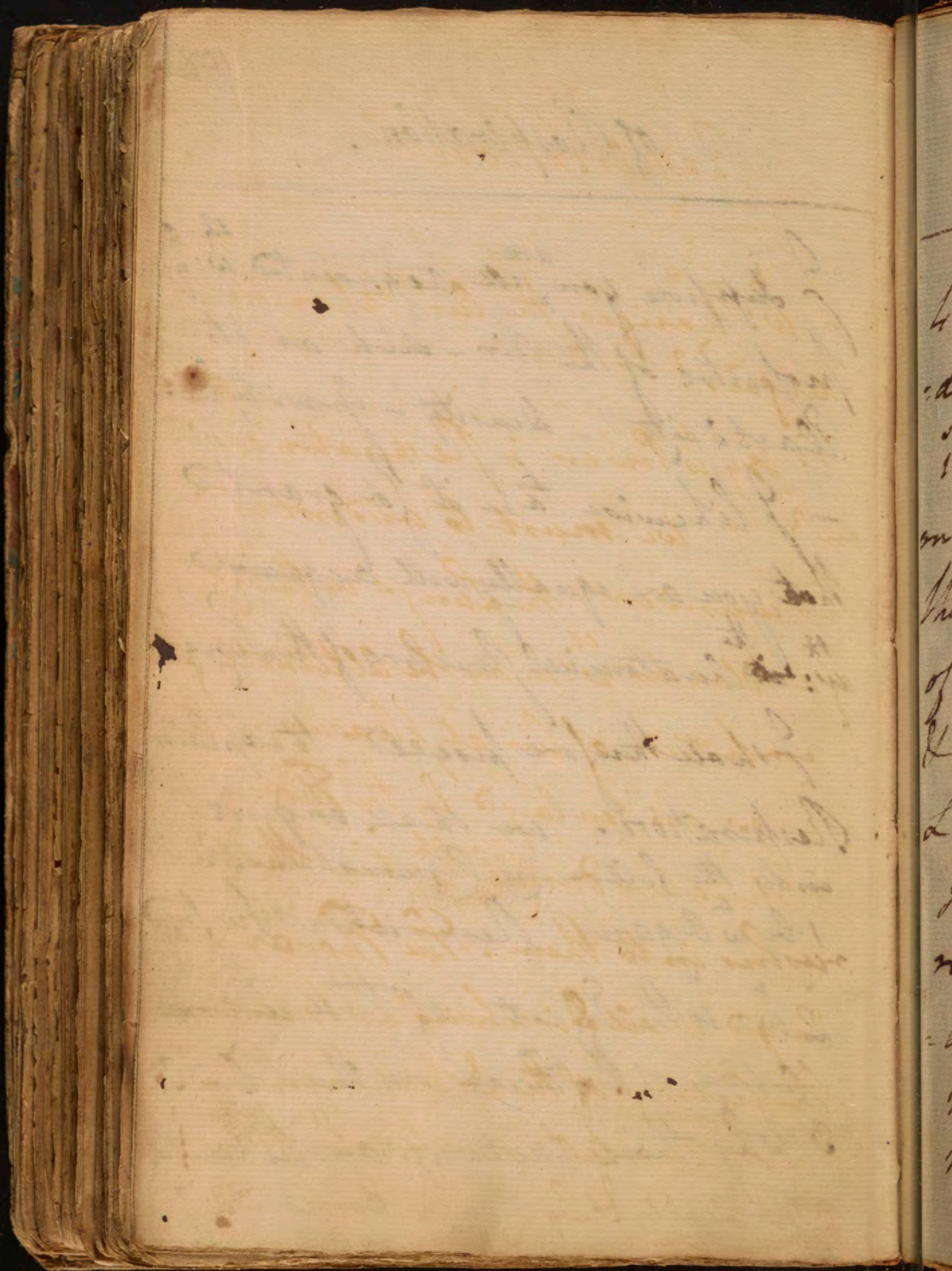
[Faint handwriting visible on the adjacent page to the right]

of Respiration.

I suppose you ^{are} all acquainted wth q^{ty} Properties of the Air - such as its Elasticity - Density - Gravity &c.
- I likewise take it for granted that you are equally well acquainted wth ^{the} anatomical structure of the Lungs.

I shall therefore proceed to explain Respiration. we shall enquire into the following Circumstances.

1. by w^h Organs Respiration is performed.
2. w^h is the Effect of these Alternations of the Thorax on the Blood?
3. Why these Motions are alternate?



Respiration

4th w: Changes the Air taken in in-
degrees?

5th w: Power is Respiration carried
on? — we must to understand
this consider the Lungs in the light
of a bladder w: may be alternately filled
& emptied of air at pleasure. The
Lungs are enlarged by the Thorax in
Inspiration during w: time the Air
rushes into them. The Thorax is en-
larged in all Directions in breathing by
the Action of the Diaphragm and
the Intercostal Muscles by the first
vertically, & by the last Horizontally.

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Respiration

2nd 3rd Q: What are the Effects of these Alter-
 : nate Dilatations & Contractions of the
 Lungs on the motion of the Blood?
 - To quicken its passage thro the
 Lungs.

3rd Q: Why are they alternated? from an
 uneasy sensation which the Lungs
 feel after Inspiration & Expiration.

- Inspiration is a violent state from
 the exertion of muscular parts, & upon
 this Acc^t: Expiration very naturally
 follows it. There is another use or
 necessity for Respiration ~~by~~ which
 leads us to enquire in to

1840

My dear Sir
I have the honor to acknowledge
the receipt of your letter of the
10th inst. and in reply to inform
you that the same has been
forwarded to the proper
authorities for their consideration.
I am, Sir, very respectfully,
Your obedient servant,
J. H. [Signature]

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I am, Sir, very respectfully,
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J. H. [Signature]

Respiration

1st The Changes w^{ch} the Air undergoes
 in Breathing? This was supposed
 formerly to lose its Elasticity by being
 taken into the Lungs, but some late
 Experiments show us y^t the Elas-
 ticity of the Air is rather increased
 than diminished. There are many
 Other Opinions of the Changes of y^e Air
 in the Lungs w^{ch} do not deserve our
 Notice. The present established Pri-
 nciple is that there are vapours exhaled
 from the Lungs Analagous to that
 w^{ch} rises from many places in y^e Earth
 & from Liquors in Fermentation.

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of Respiration

These vapours are called Mephitic Air.
 It is universally a Poison to Animal
 Life. There is no other way of rendering
 it inert but diffusing it with common
 Atmospheric Air. Respiration then
 seems to be provided as an Outlet.
 to this vapour, common Air seems
 to dissolve this Air, it is capable of
 being saturated wth it in such a
 manner as to serve ~~and~~ the Lungs
 only for a certain time in a limited
 Quantity.

Effects of the Circulation

We come now to speak of the Effects of the Circulation of the Blood. there are 1st to distribute Heat to all parts of the body.

2nd to Distribute Humidity to the body.

3rd to give Tension to the system. - it is well known y^t it stretches y^e Arteries, & I may add every Muscular Fibre too.

4th to afford secreted Liquors, and among Others the nutritive Juice. This leads us to speak of what we proposed formerly as the Chemical part of our System, or to the Doctrine of

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Main body of handwritten text, consisting of several lines of cursive script, mostly illegible due to fading and bleed-through.

Fragment of handwritten text visible on the right edge of the page, including words like "me", "to", "add", "and", "of", "ma", "the", "a".

Digestion

Animal Fluids. Some begin wth the
 Blood as Dr. Haller, Others begin with
 the Matter out of w^{ch} the Fluids are for-
 med. The latter of these Methods appears
 to me to be the best, & I shall therefore
 adopt it. in considering these subjects
 many Actions occur such as Mastication
 Deglutition &c which have no immediate
 Connection wth the nature of Animal Fluids
 so y^t I shall take no notice of them, but
 proceed immediately to consider the nature
 of Animal Nourishment of which the Ani-
 mal Solids consist. All nutritious Mat-
 ters consist Originally ^{of} ~~upon~~ vegetables
 - even those Animals on w^{ch} we live,
 are supported by vegetables, or by

Original

[Faint, illegible handwriting on aged paper]

Nutrition . . . 15

Tension on it depends. 17

Pathology of the simple

Solids. ——— 21.

Philadelphia
Pennsylvania

Philadelphia

July 13

I am friend
your friend

Philadelphia in
Pennsylvania

Escc 1

St
Michael's
Hia

